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ATTENTION AND DISTRACTION.

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Chapter I.

Introductory.

On Certain Physiological Concepts Involved in Theories of Attention.

In our later examination of various theories of attention, we shall find certain physiological concepts introduced. The validity of their use in the maintenance of different positions will be considered in connection with the discussion of the theories in whose favor they are adduced. But the concepts themselves are neither so generally accepted nor so well established by physiological experiments as to admit of our introducing them without a preliminary definition of their significance and value in physiology itself. The two topics requiring brief notices of this sort are *cerebral localization* on the one hand, and *Bahnung* and *Hemmung*—neural reinforcement or facilitation and inhibition — on the other hand.

Cerebral Localization. The physiological controversies over localization in the cortex, carried on by Hitzig, Munk, Ferrier, Goltz, Flourens, Horsley and many others, have resulted in the establishment of a few definite principles of cerebral functioning. These are summed up by Wundt as the principles of the Indifference of Function; the Substitution of Function; and the Localization of Function.[1] The same three principles are stated less formally by Waller in

[1] "*Physiologische Psychologie*," IV ed., Vol. I, pp. 235, 236.

the following words: "The clinical history of a dog or of a monkey having suffered a removal of some portion of the Rolandic area altogether negatives a strict localization of function, and at most suggests its local concentration. . . We thus picture the cortical organ in a semi-fluid state of differentiation, still variable by new instruction, rather than as a petrified and invariable collection of specialist organs tied down to particular functions and exclusively performing these functions."[1] In the same article Waller shows very clearly that the differences in theories of localization have been mainly due to a widely differing and even contradictory use of words for phenomena that were identical, and to the inferences drawn from these words.[2]

Neural Reinforcement (Facilitation) and Inhibition: "Bahnung" and "Hemmung."

We do not need to take any special notice of the physiological character and basis of inhibition. While there is still discussion in regard to its mechanism, the fact of inhibition, as tested, for instance, in the action of the *vagus* nerve on the heart, is well known and has frequently been demonstrated.

It is only mentioned here in connection with the opposite and more hypothetical process of neural reinforcement or facilitation. This latter idea plays a most prominent part in the theories of attention put forth by Exner and von Kries. They both refer to it as "a physiologically well established fact." I have searched the recent physiological journals and archives for confirmation of this statement, and have been unable to find mention of it. Exner, however, in his "*Entwurf zu einer physiologischen Erklärung der psychischen Erscheinungen*" gives his own physiological proof of the existence of *Bahnung*, and I quote rather fully from his report of the observations on which he bases this concept.

Exner uses *Bahnung* to mean just what we expect the word to mean—"the opening of a path."[3] It is a *facilitation* of the course of the nerve current, due either to its reinforcement by charges from the centre, or to the lowering of the limen of discharge.[4] Exner states that he first reached his conclusion that there must be *Bahnung* in connection with his experiments on reaction time. But he maintains also

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[1] "On the Functional Attributes of the Cerebral Cortex," *Brain*, Parts LIX and LX, 1892.

[2] *Op. cit.*, p. 346 *seq.*

[3] "*Entwurf zu einer physiologischen Erklärung der psychischen Erscheinungen*" (1894), p. 76.

[4] *Op. cit.*, p. 82.

that he has succeeded in proving its existence experimentally by the following experiments with animals.[1]

(1) Pass an electric shock through the paw of a rabbit. Since the reflex contraction follows in an animal whose brain has been severed from the spinal cord, this reflex must be controlled by a cord centre. Now lessen the electric shock until it is too weak to produce any contraction. Apply this feeble shock to the paw, and apply to the cortex a shock also too feeble to produce any result alone. If the two are given in rapid succession, one reinforces the other, and the paw is flexed. Exner states that this is not a "summation," since in summation the reinforcing stimuli follow the same path as the reinforced. Summation, however, is one particular form of *Bahnung*.

(2) A passing reference is made to the fact that the reflex contraction following a needle prick is much stronger if we give close attention to the prick. Assuming that the cortex is in a state of excitation in attention, Exner uses the phenomenon as an instance of cortical *Bahnung* of a spinal cord centre.

(3) Sternberg has observed the *Bahnung* of other reflexes in the course of his studies on *Hemmung, Ermüdung, und Bahnung der Sehnenreflexe im Rückenmarke*.[2]

(4) *Bahnung* of the other sort, where the limen for discharge is lowered, is present in the action of the *vagus* nuclei. They lie in the *medulla oblongata*, and are connected by commissural fibres. If a section is made through these fibres, each half of the body breathes independently. If the two lungs move at the same time when the nuclei are connected, this must be because an increasing charge in either affects the other, so that it is more ready to discharge; and the actual discharge of the two must be simultaneous.

(5) The fifth case is taken from von Grossman's investigations[3] of the three nuclei concerned in the breathing of the rabbit, one controlling the facial muscles, one the *vagus* muscles, and one the thoracic muscles. If one of the three is separated from its connection with the other two, these will continue to do their work; but the limen for their release of the inspiratory impulse is raised, and the animal makes movements which we call "gasping for breath." So that in this case we find the stimulation of one aiding the function of each of the others, and all three together reaching their exci-

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[1] *Op. cit.*, pp. 76-82.

[2] *Wiener Akadem. Sitzber., Bd.* C, *Abth.* III, *Juni*, 1891.

[3] "*Ueber die Athembewegungen des Kehlkopfes*," I *Theil. Wiener Akadem. Sitzber., Bd.* XCVIII, *Abth.* III, *Juli*, 1889.

tation limen at a lower point than is possible for any two, or for one alone. Notice that here we plainly have *Bahnung*, not as a reinforcement of a current, but as an influence which allows currents to pass off, or to discharge, more easily; *i. e.*, as a facilitation only.

Other physiological concepts will frequently recur in the subsequent chapters; but they are either so generally recognized as to need no special notice, or so intimately associated with the psychological theories we shall discuss later that we may advantageously consider them in their psychological connection rather than in this introductory chapter.

CHAPTER II.

The Descriptive Theories of Attention.

Before attempting to give any account of our experimental investigation of the effect upon sensible discrimination of "free" and "distracted" attention, we shall pass in review some of the most important and typical theories of attention. The whole subject is still in a somewhat chaotic state. A summary of certain representative theories will tend to bring order out of the chaos and provide a basis for a more definite and intelligible treatment of isolated experiments. The old phrase, "*Quot homines tot sententiæ*," may well be taken to represent the number and variety of theories of attention advanced by the psychologists of this century. To indicate the importance of the problem and the incompleteness of its solution, I may quote from one of the most recent investigators of the subject, Dr. Heinrich of Zurich.

> In the series of questions which concern psychology, attention takes the first and most important place. It is regarded as the fundamental condition of every human activity. In scientific investigation and thought, in practical action, in learning and teaching, attention is always a prerequisite if anything is to be accomplished. No wonder, then, that every psychology seeks to answer the question how those phenomena arise to which we give the name of Attention. * * * Yet even now psychology has no theory, only many theories. Even now, as in the "good old times," each psychologist seeks to develop a theory of his own; and very few of these can be characterized as scientific.[1]

Yet in the general confusion two tendencies are discernible, according to which the theories may be roughly divided into two classes. One class includes the more purely "descriptive" theories, with more emphasis on the physiological aspect of attention, and less distinction between psychological

[1] "*Die Aufmerksamkeit und die Funktion der Sinnesorgane*," Ebbinghaus' *Zeitschr.*, IX, 5 and 6, Jan., 1896, pp. 342, 343.

and physiological, primary and secondary phenomena. The other class includes the "explanatory" theories, with stronger emphasis on the psychological aspect of attention. Naturally, these two principles of classification intersect, and no theory is merely descriptive or explanatory, physiological or psychological. But the distinction is a matter of convenience in the present discussion, and it also expresses a real difference in the general tendency of the theorists that largely accounts for the great dissimilarity in their treatment of the question.

The present chapter takes up the more exclusively descriptive and physiological theories of attention, recognizing as its three important types the sensory, motor, and sensori-motor theories. Any ambiguity in the meaning of these terms will be cleared away as we take up in detail the several types.

I. *Theories of attention as motor.* We turn first to the motor theory, a theory which holds that attention is primarily a term covering a group or series of motor changes; processes preceding or following these changes are not an essential part of attention itself.

As the most complete presentation of a motor theory, Ribot's volume on "The Psychology of Attention" demands careful consideration. This work, however, is so well known that we need attempt no review of the discussion as a whole. We shall merely refer briefly to passages that state Ribot's position on certain contested points. After a detailed description of the "motor mechanism" and "muscular accompaniments" of attention, he definitely affirms that "these motor manifestations, with the state of consciousness which is their subjective side, *are* attention."[1] They are "its constitutive elements." And again, in speaking of voluntary attention, and of the nature of will, he maintains that "our only positive conception of will" is our idea of the action of the voluntary muscles.[2] He recognizes the intimate association between the power of attention and the frontal lobes[3]; but the correlation offers no obstacle to his theory, since he also regards the frontal lobes as the physiological organ for the regulation of the motor centres. He calls attention to three large groups of muscular concomitants[4]: (1) Vaso-motor phenomena, including both peripheral and central hyperæmia; (2) Respiratory movements; (3) "Expressive" movements of other muscles of the body. Under

[1] "*Psychologie de l'Attention*" (1889), p. 38.
[2] *Op. cit.*, p. 73.
[3] P. 67.
[4] *Op. cit.*, p. 20.

the last rubric he gives the often quoted descriptions of the muscular mechanism of attention directed outwards toward external objects, and of attention directed inwards toward internal objects.[1] Ribot finds his greatest difficulty in the application of the motor theory when he enters upon the consideration of attention to abstract ideas and concepts. He admits that the motor elements here are very feeble, but adds that "this is in accordance with the experience that abstract reflection is impossible for many, difficult and fatiguing for almost everyone."[2] He finally explains the difficulty by maintaining that abstract thought deals only with words. A motor element is found in our word ideas, though its form varies somewhat according as the individual is more or less of the motor, visual or auditory type.[3]

It seems unnecessary to give any further summary of a theory so generally known as Ribot's.[4] Before we review any other theory, however, there are three criticisms to be passed on Ribot's discussion of the attention as essentially motor. (1) He assumes that the alternative to his own theory is a denial that there is any essential connection between muscular manifestations and attention. "The *crucial* test would consist in seeing whether a man deprived of all power of external and internal motion, and of that alone, would still be capable of attention. The case is one that can not be realized."[5] But the motor phenomena may be regarded as the inseparable concomitants of attention and yet not as its "constitutive elements." They may be only one class among several of the conditions of attention. This is Külpe's view of their significance.[6] Or they may be fundamentally related by the constitution of the nervous system to other processes that have a better claim to the name of attention. This accords with Bastian's view of attention as essentially sensory, yet inseparably bound up with motor activity.[7] No theory denies that the muscles have an important part to play in the process of attention. (2) Ribot does not give any materials for the resolution of a difficulty that presents itself after a moment's reflection upon his explanation of at-

[1] Pp. 27, 28.
[2] *Op. cit.*, p. 86.
[3] *E. g.*, p. 84.
[4] Ribot's treatment of the dependence of attention on affective states, and his definition of attention as an "intellectual mono-ideism," need not concern us here. Whatever may be the logical outcome of either position, neither is so developed by Ribot himself as to modify his conception of attention as essentially motor.
[5] *Op. cit.*, p. 88.
[6] "Outlines of Psychology," tr., p. 437.
[7] *Brain*, 1892, pp. 10, 11.

tention to abstract ideas. He states that the only motor element present in such attention is in the word itself, but the character of this motor element varies in individuals according to their mental type, whether visual, auditory, or motor.[1] Now if the motor changes constitute the very nature of attention, attention itself must be dissimilar in persons of different types, and those in whom the motor element is most distinct will have the greatest power of attention. Different degrees of attention would be merely different degrees of motor adjustment. (3) Ribot fails to analyze the idea of movement. Ordinarily he refers to the purely physiological aspects of movement, and speaks of attention as their sum. But even when he is definitely concerned with the psychological aspect of movement,[2] he refers to ideas of movement without analysis or definition of the term. The phrase, "idea of movement," can properly be used only in two senses: to mean (a) the idea to which movement itself is a stimulus; and (b) the idea upon which is based the knowledge that we have moved. Of the two definitions, the first presents the more legitimate use of the term. Just as the idea of sound is that to which the excitation of the auditory organ is a stimulus, so the idea of movement is the idea to which the excitation of the articular sensibility is a stimulus. By the second definition "ideas of movement" belong to the same class as ideas of magnitude or distance, and include in their content sensations of any and all sorts. But, in either case, the content of the term is a homogeneous or a heterogeneous mass of sensations. So it has come to pass that other psychologists, studying the same phenomena, reject Ribot's statement that the attention is essentially motor, and regard it as essentially sensory. The separation of these sensory and motor theories is an artificial one, but before completing their reconciliation, the differences between the two should be presented from the point of view of the "sensory" theorists.

II. *Theory of attention as sensory.* The sensory theory has been presented in a rather fragmentary way, by writers more directly concerned with the criticism of the motor theory than with the systematic formulation of their own views. The most complete statements of the position yet made are those of Bastian[3] and Marillier.[4]

Marillier defines attention as "a state of consciousness which is the result of the temporary predominance of one

[1] *Op. cit.*, pp. 84-88.
[2] *Op. cit., e. g.*, p. 72.
[3] "On the Neural Processes underlying Attention and Volition," *Brain*, LVII, 1892, pp. 1-34.
[4] "*Sur le Mécanisme de l'Attention*," *Rev. Phil.*, 1889, pp. 566-588.

representation over the representations which are coexistent with it at any given moment."[1] He maintains that Ribot's analysis of the muscular movements in attention really proves "that what is essential here is the reinforcement of a representation, and that sensations are what determine this reinforcement. Movements are only a condition, as indispensable as you choose, but not an element of the phenomenon. What he [Ribot] succeeds in showing, after a long analysis of the mechanism of the voluntary attention, is the very important part played by muscular sensations in the memory of images and words."[2] Marillier goes on to say that after admitting that motor phenomena often play an important part in attention through the sensations which they excite, we must still protest against the implication that such peripheral excitation is the only way in which a representation may be reinforced. Account must also be taken of the interaction of the centres upon one another.[3] His objection to Ribot's definition of attention as essentially motor is, then, up to this point, a two-fold objection.

(1) Admitting that motor phenomena have often a prominent part in attention, we must at the same time trace these phenomena backward to their rise in sensations, and forward to their excitation of the sensations of movement; so that on this ground alone attention should be called sensory rather than motor. (2) Ribot's account of the motor mechanism fails to recognize the interaction of sensory centres and of motor and sensory centres, and moreover—here Marillier introduces a yet more fundamental objection—the motor adjustment is often such that it fails to reinforce, or hinders the attention. This is ordinarily the case as attention grows more profound. Excitation of the sensory centres, up to a certain degree, occasions a series of muscular changes well adapted to reinforce the original sensory excitation by the sensations to which they give rise. By connate or acquired associations of certain sensations with motor adjustment, it is possible for an originally feeble sensation to be so intensified as to absorb attention. Take, for instance, the case of a dog perceiving the faint odor left in the track of a hare. The sensation has awakened strong impulses, and his attention is so absorbed that he can scarcely hear the shouts of his master.[4] But in both animals and men, if the excitation is further increased, its propagation is no longer confined to definite motor centres, so as to produce coördinated move-

[1] *Op. cit.*, p. 566.
[2] *Op. cit*, p. 572.
[3] *Op. cit.*, *e. g.*, pp. 572, 587.
[4] *Op. cit.*, p. 574.

ments of a definite sort. It is diffused and results in irregular and disordered movements.

"They are no longer adapted to any end. A man makes gestures, speaks in a loud voice, walks back and forth, stops, starts again, waves his arms in the air, takes his hair in both hands ; his mouth works in a thousand ways; sometimes his face becomes rigid, his eyes are fixed, his brows contracted, his forehead lined with wrinkles, his hands tremble, his voice is hoarse, speech is difficult, breathing is obstructed. . . . If the excitation increases still further, there is a change again : the muscles relax, ... the heart beats irregularly and slowly, the skin becomes pale and cold, ... until at last there may be an arrest of the heart and the respiratory centre, and a total loss of consciousness."[1]

Marillier adduces as a subordinate proof of the lack of thorough cöordination of the motor and sensory centres the fact that morbid states of the attention are not ordinarily associated with motor troubles.[2]

Illustrations of similar cases of attention, not covered by Ribot's theory, are presented in an article by Sully.[3] The two most detailed descriptions can best be given in his own words :

"I was walking along a narrow lane lost in thought. I came on a lamp which shot its rays through the fog. I involuntarily stood still and fixated the lamp, thinking all the while intently on my psychological problem. When this intellectual effort relaxed, and not till then, I saw and recognized the lamp. Now here was energetic muscular action, and equally energetic concentration ; but what was the relation of the two ? That this involuntary assumption of the attitude of the seer, of the fixed head, convergent eyes, etc., somehow aided the process of mental concentration, is certain. But was this muscular adjustment the *whole* of the process ? If so, I ought surely to have been mentally occupied by no abstruse problem of psychology, but with the concrete sensible object before my eyes, even though it had been far less brilliant and imposing an object than the lamp. . . . The same partial independence of the process of attention and of the motor process appears, too, in ideational attention. If I think, for example, of a circle, with the eyes closed, . . . I not only have muscular sensations which tell me that the peripheral organ by means of which I acquired the idea is engaged, but I am aware of a motor impulse to retrace the curve of the circle. . . . But now let us suppose that I am trying to visualize, not any particular form, but merely some shade of color, say, peacock blue. In this case I certainly find the motor element much less prominent. I am hardly aware, indeed, in this instance, of any ocular strain, and should say the eyes were in the easy and natural position, described by Helmholtz as the primary position, nor does attention resolve itself in this case into a renewal of the muscular action concerned in uttering the name of the color.

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[1] *Op. cit.*, p. 576.
[2] *Op. cit.*, p. 580.
[3] "The Psycho-physical Process in Attention," *Brain*, 1890, pp. 145-165.

Indeed, I find that any thought of the name distinctly disturbs the visualizing process. And yet, though the muscular element in this case is, to say the least of it, considerably reduced, the active consciousness, the attention, is as clearly present as before."[1]

Sully compares the relation between attention and motor changes with "that which obtains between an emotion and the several sensory and motor phenomena which accompany it. Fear is always accompanied by characteristic physiological changes; . . . and fear would not be fear but for these processes which contribute, in the sensations to which they give rise, characteristic features to the mental state. Yet when Prof. W. James of Harvard College not long since proposed to prove that emotion is nothing but the result of the organic changes and correlated sensations, most persons probably regarded the proposal as paradoxical."[2]

Bastian is in substantial agreement with the parts of Marillier's and Sully's views that have here been presented. But he attacks two positions maintained by Marillier and Sully, not mentioned in the digest of their articles given above, because reserved for more extended notice here. The contested positions are: (1) The correlation of consciousness with efferent nerve currents in the cortex; and (2) the existence of motor and sensory centres in the cortex. After the discussion of these topics we shall pass on to the consideration of the second great class of theories of attention—the explanatory.

I. *The correlation of consciousness with efferent nerve currents.* With regard to the first position, the correlation of consciousness with efferent nerve currents in the cortex, Sully, Marillier, Fouillée, Waller and others maintain that there is such a correlation; while Bastian, Wundt, James, Münsterberg and others assert that motor centres or efferent currents have no correlative consciousness whatever. The point is not one of ultimate importance in the controversy between the sensory and motor theories, as is evident, indeed, from the fact that writers who agree in calling attention essentially sensory differ in regard to their ideas of "motor consciousness." The opposing theories could be reconciled on the basis already suggested, *i. e.*, the reference of the word "motor" to "ideas of movement," whether initiated solely by peripheral or also by central processes. Yet the subject is one of vital importance for the theory of attention in general, and it has been given such a prominent place in the sensori-

[1] *Op. cit.*, pp. 156-157. Sully also cites Helmholtz's instance of attention to an object in the lateral regions of the field of vision. But recent experiments made by Heinrich in the laboratory at Vienna, show that there is a change in the accommodation of the eye when the attention is directed to the side of the field of vision or to mental operations. See Ebbinghaus' *Zeitschrift*, Bd. IX, January, 1896.

[2] *Op. cit.*, p. 157.

motor discussions that it may properly be discussed in this chapter. We can only quote a few typical passages from both sides of the controversy. No one ventures to assert yet that the matter is finally settled.

To present the negative side of the issue, first, we quote from Bastian, James, Wundt and Münsterberg.

Bastian writes: "In my opinion, the ganglionic elements concerned with the motor side of this activity [*i. e.*, attention] lie altogether outside the cerebral hemispheres, just as the activity of such motor mechanisms lies altogether outside the sphere of consciousness."[1] Again he refers to certain expressions "as implying that there are motor centres in the cortex and that their activity carries with it a subjective phasis; both of which positions I, in common with James, Münsterberg and others, believe to be erroneous."[2]

In a diagram in this same article, Bastian pictures a sensory centre, one of his "kinæsthetic" centres, in connection with an afferent spinal (sensory) centre and an efferent spinal (motor) centre.[3] The fibres of the pyramidal tract connecting the kinæsthetic centres and the spinal motor centres he prefers to call "internuncial" rather than efferent, and their functioning is attended by no psychical accompaniments. And so because the kinæsthetic centre is situated on the afferent side of the nervous tract, it should not be called "sensori-motor," but merely "sensory."[4]

Prof. James does not fully agree with Bastian; for he speaks of "the distinction of sensory and motor cells as having no fundamental significance,"[5] and yet he also excludes the motor zone from the sphere of consciousness.

"If the motor cells are distinct structures, they are as insentient as the motor trunks are after the posterior roots are cut. If they are not distinct structures, but are only the last sensory cells, . . . then their consciousness is that of kinæsthetic ideas and sensations merely, and consciousness accompanies the rise of activity in them rather than its discharge."[6]

Wundt, in his last edition of the *Physiologische Psychologie*, describes the "sensation of movement" as derived from four sources: pressure sensations, articular sensations, muscular (contraction) sensations, and innervation sensations. The existence of innervation sensations in the sense of centrally excited components of the idea of movement has been fully established, but Wundt defines these central components as

[1] *Op. cit.*, p. 13.
[2] *Op. cit.*, p. 27, note.
[3] *E. g.*, p. 31.
[4] *Op. cit.*, p. 32.
[5] "Principles of Psychology," II, p. 581.
[6] *Op. cit.*, II, p. 517.

"*memorial images of previous movements*, . . . which partly introduce and partly accompany every voluntary movement. Since memorial images possess qualitatively the same sensation content as the original perceptions, such central sensations of pressure and movement, under normal conditions, will completely fuse with the more intense peripheral sensations of the same kind. But they will produce an independent effect if for any reason the peripheral sensations are suppressed."[1] The term *Innervations-empfindungen* has been so widely misused and misunderstood that Wundt gives it up in his fourth edition, and uses in its place more general terms, "central components," or "central sensations." Other passages, showing Wundt's definition of the term in the third edition of the *Physiologische Psychologie*, and elsewhere, are quoted by Prof. Titchener in *Mind*, N. S., Vol. II, 1893, p. 143. Münsterberg's analysis of the sensation of innervation in *Die Willenshandlung*, pp. 75-88, reaches the same results.

On the affirmative side of this question concerning the association of consciousness with motor processes, we quote first from Marillier.

"The feeling of muscular effort, as the writings of William James and more recent experiments have proved, can be wholly traced back to muscular and tactile sensations; it disappears in anæsthesia. But beside this feeling, there is another, a feeling of cerebral effort, of the more or less easy functioning of the sensory and motor centres."[2]

Sully takes the same position in the following statement:

"If every psychical difference of quality is to have its corresponding physiological difference, there is some *a priori* reason for correlating the great and profound difference between passive sensation and active consciousness with the most important and radical difference observable in the nervous process, viz., that between the afferent and efferent current."[3]

In commenting on Sully's paper, Fouillée expresses the same opinion more strongly.

"Münsterberg denies that motor impulse is accompanied by any psychical phenomenon before movements have taken place in the limbs through muscular action. This negation is entirely gratuitous. Everything that produces rupture of cerebral equilibrium must produce a contrast in the cœnæsthesia, and contrast is the very condition of distinct consciousness. Now motor discharge, even when it is spent not upon muscles, but intra-cerebrally in the form of innervation of sensory and ideational centres, involves a sudden transformation of tension into *vis viva*, of potential energy into actual energy. This sudden rupture of physical equilibrium

[1] *Phys. Psych.* (IV*te Aufl.*), *S.* 425.
[2] *Op. cit.*, p. 586.
[3] *Op. cit.*, p. 155. *Cf.* "The Human Mind," I, p. 122.

must have its psychical counterpart; it constitutes cerebral work of a very different nature to cerebral passivity, and we call this work the substratum of attention. We are not conscious of the centrifugal current once let loose upon the muscles beyond the cerebral centres; we then experience, as a sort of *choc en retour*, mere passive muscular feelings. But we are conscious of the *starting* of a centrifugal current at the instant it is liberated in the brain."[1]

Waller, in his special study of the sense of effort, reaches the conclusion that effort and fatigue "are in major part central, in minor part muscular."[2] In the introduction to his account of his experimental study of fatigue, Waller refers to the two sides of the question, and the proper method for its solution, in the following words:

"The opinion that the sense of effort is a subjective concomitant of the outgoing nerve flow, is not in fashion with most working neurologists of the present day. Bastian goes the length of referring to it as "a doctrine now disproved," and Ferrier "is thoroughly in agreement with Bastian as to the sense of movement being dependent on centripetal impressions and not on outgoing currents." There is, however, as Dr. Jackson says, no reason why states of consciousness should not attend activities of motor as well as of sensory cells. . . . . In fact, as it seems to me, the proposition and its negative are of equal weight, equally admissible as statements of opinion, equally unproven and undisproven by the arguments invoked for and against them. *A priori* tenability is not proof, but failure of proof is not disproof. And I cannot admit as a positive premise either the opinion of Bain or the dictum of Bastian — the first to the effect that we know our movements by a central sense of motor emission, the second to the effect that the sense of effort as a concomitant of central motor innervation has been disproved. An appeal to our own feelings of effort does not prove one thing or the other; observations of clinical phenomena leave the matter unsettled; experiments on animals give answers which must be dressed out with interpretation and inference. There remains, however, in my opinion, very definite and accessible *objective* evidence to be obtained by the study of the manifestations of fatigue on man quite apart from introspective self-analysis."[3]

The "objective evidence" referred to in the paragraph just quoted was collected from a series of experiments with the sense of fatigue. The whole experimental proof proceeds upon the assumption of the similarity of "the sense of movement" and "the sense of fatigue."[4] He argues that "the incidence of fatigue" (which is the *result* of movement) may be taken as a guide to the incidence of "effort" (which is the concomitant of movement).[5] Waller concludes that effort is

[1] "Remarks on Mr. Sully's paper," *Brain*, XIII (1890), pp. 352, 353.
[2] "The Sense of Effort: an Objective Study," *Brain*, XIV (1891), p. 247.
[3] *Op. cit.*, pp. 179, 180.
[4] *E. g.*, pp. 187, 188.
[5] *Brain*, 1892, p. 380.

dependent on changes both at the centre and at the periphery. But it is not clear just what he means by this conclusion. He seems inclined to admit two kinds of consciousness, correlated with the central changes. He frequently contends that he can not agree "with the arbitrary and dogmatic exclusion of the motor zone from the sphere of consciousness."[1] And although with reference to Prof. James' discussion of the sense of effort,[2] he says, "I fully admit the destructive character of his arguments as opposed to the introspective and circumstantial evidence of a central feeling of innervation,"[3] yet he maintains that there is experimental proof of the existence of a sense of effort which is "a subjective concomitant of the outgoing nerve-current."

Such an account of what is involved in the central changes seems to us rather obscure and inconclusive, besides being inconsistent with Waller's theory of the cortical centres. He holds that there are neither motor nor sensory centres.

> "Any 'motor' or discharging centre must also be a 'sensory' or receiving centre; it must be excited as well as excite. Any sensory centre must also be motor, directly or indirectly; else we could have no objective tokens of sensation; every centre, whether called sensory or motor, is *terminus ad quem* as well as *terminus a quo*."[4]

With such a conception of the cortical centres, it seems to us that Waller, to be consistent, should be as decidedly opposed to any theory of two kinds of consciousness as he is to the theory of two kinds of brain centres. We may grant all that he asserts as the result of his experiments with regard to the existence of central elements in effort and fatigue, and all that he maintains with regard to the sensori-motor nature of the cortex; but instead of seeing that there is any contradiction here of the interpretation of effort given by Wundt and Münsterberg, the two assertions just stated and the preceding quotations from Dr. Waller's articles are irreconcilable, except from Wundt's standpoint.

II. *Sensory and motor, or sensori-motor cortical centres.* The question whether the function of the cortex is sensory, motor, or sensori-motor, is as important with regard to the physiological basis for the theories discussed in this chapter as was the analysis of the meaning of "motor," "ideas of movement," etc., for the psychological investigation of the theories. In the psychological analysis we found that much of the apparent opposition arose from an obscure and diver-

[1] "Principles of Psychology," II, 449-518.
[2] *Brain*, 1891, p. 241.
[3] *Brain*, 1892, p. 351.
[4] *Brain*, 1892, p. 352. See also pp. 342, 343.

gent use of the same terms. The same phenomena can be described as motor when objectively regarded, and as sensory when subjectively regarded. The only ground, then, left for the controversy was the hypothetical distinction of sensory and motor in the physiological processes of the cortex. If there is no such distinction, if Waller's description of the cortex as essentially "sensori-motor" is true to the facts, then the sensory and motor controversy must come to an end. We should combine in one the observations and the verified inferences contributed by writers on both sides, and then turn to discussions of attention from some other standpoint, in search of some explanation for the descriptive theories of the present chapter. But we are forecasting the end before the final test is applied. What, then, *is* the current physiological theory with reference to the existence of sensory and motor centres in the brain?

We consider this topic in accordance with the principles of cerebral function stated in the preceding chapter. When we speak of localization, the term is used in the sense there defined. The dispute over the cortex as sensory, motor, or sensori-motor has long been waged. The names of many of the disputants have become familiar even to the general public, and it is quite unnecessary for us to review the history of the discussions between Flourens, Goltz, Munk, Hitzig, Ferrier, Gotch and Horsley, Schäfer, Schiff, Bechterew, etc. Summaries of the controversy have been given by Waller in the article on the "Functional Attributes of the Cortex," already referred to,[1] and by Mott in a discussion of the "Sensory Motor Functions of the Central Convolutions of the Cortex," published in the *Journal of Physiology* for 1894.[2] Dr. Mott's conclusions, from his own experiments as well as from his review of the experiments of others, favor the view of the cortex as sensori-motor. "I think that clinical experience, experiment, and anatomical investigation all tend to show that these cortical cells are discharged by sensory impulses traveling up fibres which terminate in the so-called 'motor area,' and that it is not 'purely motor,' but 'sensori-motor.'" "The fact still remains that motor paralysis is greatly in excess of the sensory disturbance in many clinical cases. This may be explained by comparing the expansion of the centrifugal and centripetal fibres to two funnels. . . . The base of the efferent cone consists of trunks, from which all the branches and collaterals spring. The base of the sensory cone consists only of the terminal twigs after

[1] *Brain*, 1892, pp. 329-396.
[2] *Journal of Physiology*, 1894, pp. 464-487.

collaterals have been given off."[1] Waller's quotations from both sides of the controversy show that "the differences of view have involved matters of fact far less than inferences from facts as embodied in words."[2] In fact, he calls attention to the inferences *necessarily* involved in the use of such terms for cerebral processes. "We are in presence of a central process associated with centripetal and centrifugal processes, and we have no right to say that the centre is motor, or sensory, or both, otherwise than inferentially."[3]

Still another view of the relation of sensory and motor activities is presented by Külpe in his "Outlines of Psychology." His explanation of the rapid restoration of sensory functions in the cortex depends upon reference to physiological processes, while Mott's explanation depends upon the anatomical fact of the distribution of the fibres.

"All these phenomena (*i. e.*, of recovery of sensation and loss of movement) are evidence that the specific function of a nervous excitation is as a rule dependent upon its normal place of origin: the peripheral organ in the case of sensory nerves, the central in the case of motor. It would seem, therefore, that we may compare the unknown processes of the sensory centres with the known phenomena of the motor periphery, and attempt in this way to gain a more definite idea of their nature. We must then correlate a particular sensation . . . with the excitation of a larger or smaller cortical area, according to the range of the peripheral stimulation, . . . and lastly, we may designate the state of the nervous substance, in which the various cortical areas are capable of reproduction,—*functional disposition*. Just as the piano player uses hands and fingers for the most varied combinations of movements, so the same parts of the cortex may be concerned in very different forms of excitation."[4]

This brief review of the physiological basis for the distinction of sensory and motor centres indicates that the distinction is not by any means so definite as sensory and motor theories of attention have made it. Both on physiological and psychological grounds, it is more correct to speak of attention as sensori-motor than as sensory or motor. Even if, however, separate areas are assumed for sensations and movements, so that the two are anatomically distinguishable, it is universally admitted that they are as mutually *dependent* in physiological function as sensation and movement themselves are in psychological analysis. Attention *must be* sensori-motor: sensory in its contents, motor in its mani-

[1] *Op. cit.*, pp. 480, 469. A diagram accompanies the last passage cited, and makes clear the meaning of the somewhat obscure statement.
[2] *Op. cit.*, p. 346.
[3] P. 342.
[4] "Outlines of Psychology," tr. p. 223.

festations, sensori-motor in its whole process. In the acceptance of this opinion the sensori-motor controversy is ended so far as we are concerned. But we have still reached no explanation of attention, no true definition of it. We have a description of its phenomena—subjectively in sensations, objectively in movements,—and we refer both to one general, continuous, physiological process. But this process accompanies all consciousness, and sensation and movement are present in every phase of consciousness. We must look further for the peculiar physiological processes, and for the psychological conditions which are the basis of attention itself.

Chapter III.

The Explanatory Theories of Attention.

The theories of the preceding chapter have been referred to as "descriptive"; those of the present chapter we call "explanatory." We have alluded to many facts and observations of attention which we may classify together as the outward expressions of the attention. We have also passed in review the reasons for characterizing attention as a sensory, a motor, or a sensori-motor process. But we have not yet been told what attention *is*. The theories have been either too narrow, defining it in terms of its secondary phenomena, or else they have been too broad, characterizing it in terms that apply to consciousness in general. The present chapter, however, is devoted to theories that do ascribe a specific function to attention. We have the essential, constitutive elements distinguished from the secondary, attendant phenomena, and the relations between the two are carefully analyzed. We have, thus, a definition of what attention is, and an explanation of its contents in the sense of a reference of all contents to fundamental principles of psychology and physiology.

There have been three types of explanatory theories. Attention is regarded (1) as essentially a facilitation of ideas; (2) as an inhibition of ideas; and (3) as both facilitation and inhibition.

I. *Theories of attention as a facilitation of ideas.* G. E. Müller is often referred to as the chief representative of the first type (*e. g.*, by Külpe). From his statement of the thesis of his monograph "*Zur Theorie der sinnlichen Aufmerksamkeit*," we should expect to find him in the third class, with those holding a mixed theory of attention. His thesis maintains that "the capacity for acting on the mind which is possessed by certain physical processes in the central organ, may

be modified by the activity of the sensible attention; they may be increased or diminished, or wholly destroyed."[1] If we look only at Müller's discussion of the physiological changes involved in attention, we must admit that he investigates both sorts of modifications mentioned in his thesis, — the inhibitory as well as the facilitatory. Külpe's criticism that Müller fails to discuss the phenomenon of inhibition ignores such passages as that extending from page 105 to page 110, as well as minor references scattered through the work.[2] On the other hand Müller certainly lays far more stress on the reinforcing than on the inhibiting function of attention. In fact, when he is confining himself to the psychological analysis of attention, he does almost entirely ignore all changes except those which he describes as reinforcements of a sensation or idea. Hence, we shall concern ourselves here only with those parts of the theory which maintain that attention is a facilitatory process.

We may neglect Müller's presupposition of "a mind that absorbs a part of the energy with which a nerve acts upon it for the production of an equivalent of mental activity."[3] His statement of his observations and most of his conclusions can easily be translated into the terms of a psychophysical theory.

In the summary of his discussion of voluntary attention, Müller mentions three ways in which attention reinforces its object. "We have found that the activity of the voluntary sensible attention consists, in many instances, in the effort to reproduce earlier sensations; in other cases, it may be evident merely in impulses imparted to motor nerves, and resulting in the adaptation of a sense organ;" this adaptation, in turn, may react on the central organs, reinforcing the idea through associations.[4] We have, then, an adaptation of the sense organ to the stimulus, a facilitation of the excitation corresponding to the stimulus in the central nervous system, and correlated with these the recollection of similar ideas previously experienced.

The brief statement just given includes what is of greatest theoretical importance in Müller's discussion. The most valuable part of the work—the application of these principles to a very large number of concrete cases, — we cannot dwell upon here. Müller's examples include references to Helmholtz, Wundt, Volkmann, G. H. Meyer, Lotze, and many others hardly less noteworthy. But his conclusions

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[1] "*Zur Theorie der sinnlichen Aufmerksamkeit*," Leipzig (1873), p. 1.
[2] *E. g.*, pp. 14, 67, 71.
[3] *Op. cit.*, p. 70.
[4] *Op. cit.*, p. 103. See also p. 48.

are not systematically worked out, and his presupposition of a "mind" acting upon a "sensorium" has prevented his recognition of certain problems in attention which are the natural outcome of his theory, *e. g.*, the question of our knowledge of the difference between increased intensity due to the stimulus and increased intensity due to the attention. Such problems will recur when we reach the discussion of the third type of the explanatory theories. Meanwhile we must examine the second type of theory, that which is directly opposed to Müller's, and which, both logically and chronologically, is the next in order for our investigation. The two chief representatives of the theory that attention is essentially inhibitory are Wundt and Külpe.

II. *Theories of attention as an inhibition of ideas. A: Wundt's theory.* Wundt analyzes the whole process of attention into the following subordinate processes:

"(1) Increase of the clearness of a definite idea or group of ideas, accompanied by the feeling which is characteristic of the whole process from the beginning; (2) Inhibition of other available impressions or memorial images; (3) Sensations of muscular strain, with the sense feelings which belong to them and which intensify the primary feeling; (4) Intensification of the sensory contents of the apperceived idea by these strain sensations through the medium of associative co-excitation. Only the first and second of these four part-processes are essential elements of every act of apperception. The third may be of very slight intensity, or even entirely wanting; the fourth is demonstrable only in cases where the third, of which it is a secondary consequence, attains a certain duration and intensity."[1]

In our attempt to summarize Wundt's theory of attention, we shall take up the constitutive factors (part-processes) in the order just given. It is not the order in which they are discussed in the section on *Aufmerksamkeit und Apperception*, but it is evidently the order of their importance according to Wundt's own estimate.

The first process is "an increase of clearness of an idea with an accompanying feeling of activity." Clearness is distinguished from intensity.

"Since the intensity of the sensations which make up an idea exercises an undoubted influence on its clearness, these two concepts are often confused. But in strictness we can attribute intensity only to the sensation-elements, not to the idea itself. . . . . The essential difference between the clearness of an idea and the intensity of its sensation-components is shown above all in the fact that an increase and decrease in clearness can occur without a simultaneous increase and decrease of sensation-intensity. . . . If a continuous stimulus is allowed to act on a sense organ, even under conditions which preclude fatigue of the organ, it is more or less impossible to apperceive it continuously with the same clear-

[1] *Phys. Psychologie*, IVte *Aufl.*, II, 274.

ness and distinctness. A constant change in clearness is noticed, and this change appears to the subject as a process which is different from any objective oscillation in the intensity of stimulus. . . . If clearness and intensity are so entirely different, then the concept of the stimulus-limen acquires a double significance. As limen of *intensity* it means a limen of *consciousness*, since the entrance into consciousness (perception) of an idea depends upon the intensity of its sensory contents. The limen of *clearness* is something different; it is a limen of *attention* or *apperception*. Only impressions which lie above the limen of intensity can transcend the limen of apperception. But, if this is to happen, the subjective function of attention must also be discharged. . . . . We have proved, then, that an impression may oftentimes become clearer without growing stronger, and vice versa, and that the two processes are subjectively distinct. Still, this does not prevent their exerting a certain influence on each other. . . . An intensive impression, provided that there are no special dispositions present to oppose it, is ordinarily apperceived more strongly than a weak impression. But undoubtedly certain influences may be exerted in the contrary direction as well; as . . . when one makes an effort to recollect or to imagine, and tries to keep his ideas in consciousness at the highest possible degree of intensity. . . . Many persons, it would seem, are successful in increasing the clearness of such images, but are absolutely unable to increase their intensity to any marked degree. . . . Increase of clearness always precedes increase of intensity, and the latter always takes place more slowly, and appears as the accompaniment of strong strain sensations,—the character of the muscular excitation naturally being in exact correspondence to the form of the apperceived idea. . . . It is extremely probable that the intensification of sensations is a *secondary* effect, which may be—but is not necessarily—produced by certain concomitant phenomena of attention."[1]

Wundt's statements of the distinction between clearness and intensity have been quoted at length not only because the distinction is of such importance to his own theory, but also because the relation of the two phenomena is one of the most vital questions in any complete theory of attention. We shall return to this point later. We have now to consider the first part-process from its second point of view, *viz.*, the feeling of activity which Wundt has associated with the increasing clearness of an idea.

It must be noticed that "feeling of activity" is frequently used as a general term, including the negative feeling of passivity as well as the positive feeling of activity; for Wundt has two classes of attention, the passive and the active, and if we use the *Thätigkeitsgefühl* as the characteristic feeling accompanying increased clearness of an idea, it must be remembered that the term also covers the feeling present in passive apperception. To simplify matters we shall consider the term in this section only in its restricted and more ordinary meaning.

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[1] *Op. cit.*, II, pp. 271-274.

Wundt states that the feeling can not be analyzed or defined. This remark is constantly quoted by his critics. Some misunderstand Wundt so far as to maintain that he is introducing a metaphysical concept. Wundt himself, however, distinctly states that he is speaking of "empirical facts and not of any metaphysical conception."[1] Other critics, proceeding on the presupposition that sensations are the only elements of mind, object to Wundt's *Thätigkeitsgefühl* because it has no content; and, thus condemning his introduction of a "feeling of activity," assume that his whole theory has been demolished by such condemnation.

Criticism of this sort is crude and ill-considered. It is true that certain passages in Wundt's writings give some basis for it, but the discussion as a whole cannot be overturned by the demonstration of a few small inconsistencies. We are bound to admit that there are inconsistencies in Wundt's account of the "feeling of activity," but they have been exaggerated, and, moreover, the whole theory of attention has been made to depend upon the validity of this one factor. We hope to show that the "feeling of activity" is not essential for the logical coherence of the rest of the theory in general. But before we take up its relation to the discussion as a whole, we should notice carefully what Wundt himself has to say in defense of the much criticised *Thätigkeitsgefühl*. He first characterizes it as a feeling *preceding* the apperception or the increased clearness of an idea. "And we think of the ideas associated with this feeling as originated by ourselves. Other ideas are accompanied by the feeling of passivity. This latter feeling comes into existence *simultaneously* with its associated ideas, so that the idea seems to arise without any activity on our part."[2] But the feeling of activity does not merely precede, it may also persist, even when an idea has reached perfect clearness in consciousness. In this connection Wundt indicates that the feeling itself cannot take sole possession of consciousness. In the interval that he refers to as "preceding" that of the full clearness of an idea, the feeling accompanies the appearance of a series of memory images and their more or less complete fusion with the idea attended to.[3] "At the same time definite sensations take part in the process,"—the strain sensations of Fechner; and again he says of the *Thätigkeitsgefühl*, "As soon as we reflect upon it, it is referred by us to the whole disposition (*Anlage*) of consciousness ordinarily contained in the word 'I.' But if we analyze this reflection, the feeling is brought

[1] *Op. cit.*, II, p. 284.
[2] II, p. 266.
[3] II, p. 270.

into connection with definite, complex motives, *i. e.*, with complicated associations of ideas involving strong feelings. I find that all these feelings and motives are empirically given facts."[1]

To repeat a former statement,—it seems to us that there *is* some justice in the criticism of Wundt's account of the feeling of activity as confused. He describes the feeling as unanalyzable, and yet gives it a diversity of contents. This is partly due to the fact that at one time he is regarding it from a purely subjective point of view; at another time, from an objective point of view, he sees its mechanism,—its physiological expression. Another reason for the confusion is due, in our opinion, to the indefiniteness of the whole system in its treatment of the feelings (*Gefühle*). After maintaining that there are only two affective qualities, pleasantness and unpleasantness, Wundt refers to several concrete, *unanalyzable*, feelings. The *Thätigkeitsgefühl* is such a feeling, accompanying apperception. But apperception is analyzed into conscious processes that every one must recognize, whatever name one may choose to give them. Wundt, in his last edition, does not maintain the existence of an activity of apperception as an immediate fact of consciousness, in any sense that excludes its analysis into changes in sensations or ideas with accompanying variations in their affective tone. The activity itself is an *inference* from the facts observed. "The phenomena of the connection of ideas in active attention cannot be accounted for by reference to the so-called laws of association alone, but the influence of more remote acquisitions and dispositions of consciousness makes itself felt here."[1] Later in the same passage Wundt refers to the apperceptive process as one in which "the whole past experience of consciousness influences the new impression."[2] And yet, elsewhere, he does maintain that apperception finds immediate expression in consciousness in one way—in the form of the "feeling" of activity, and this feeling is unanalyzable!

To understand what Wundt includes in the *Thätigkeitsgefühl*, why he makes it a factor in attention, and what its relative importance in the system is, we must digress for a moment, and refer briefly to his conception of the feelings in general. The digression is justified by the fact that even those who are in accord with Wundt's system as a whole often misapprehend his treatment of the "*Gefühle*" and the affective side of consciousness. It seems to us that Wundt

[1] II, p. 284.
[2] II, p. 284. See also "Human and Animal Psychology," tr., p.252.

regards the feelings from two points of view: that which considers the components or the sources of the feeling, and that which considers the very nature of the feeling itself. In many cases we are able to distinguish the components of a feeling, but the feeling itself is a *unitary* state. It is not the mere sum of its components, but their product or resultant,[1] and it is, therefore, in a sense unanalyzable and indefinable. But besides these qualitative distinctions in compound feelings, there are qualitative differences also in the most elementary feelings. Pleasantness and unpleasantness are the most common and extensive of the variations in quality, but Wundt does not hold them to be the only affective elements. "Both are qualitative states, and each may pass over into the other through a zero or indifference-point. Each of them may go through extremely different degrees of intensity or may be present in very many shades of qualitative difference."[2]

And after an account of the relation in many sense departments between the intensity of the stimulus and the feeling of pleasantness and unpleasantness, he adds that "in sensations of the two higher senses there are contrasting feelings analogous to pleasantness and unpleasantness, but not to be directly characterized by these terms."[3] Among the feelings which are connected with sensations of sound and light, every feeling has its opposite, as is the case with all classes of feelings, but the contrasting states cannot here, any more than in the case of the lower sensations, be characterized simply as pleasant or unpleasant.[4] Wundt accounts for this difference in the qualitative variety of the feelings accompanying sight and hearing by reference to "factors which have their source in the development of consciousness," due to inherited dispositions and to individual activity.[5] But this account of their origin does not make them any the less "elementary" in consciousness as we now know it.

The feelings can never exist alone. They must be con nected with a sensation or with an idea. As dependent upon ideas of sometimes very great complexity, the æsthetic, intellectual and moral feelings may be said to be complex, but as we have already noticed, Wundt emphasizes their unitary character and their absolute qualitative distinction from one another and from their component elements.

We have nothing to say here with regard to the truth or un-

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[1] "*Phys. Psych.*," II, p. 498.
[2] I, p. 555.
[3] II, p. 558. See also p. 561.
[4] I, p. 570.
[5] I, p. 590.

truth of the statements with which such a theory of "feeling" must stand or fall. They are matters of introspection and analysis quite outside of our province. We only wish to point out that feeling and emotion may be interpreted in very different ways without affecting Wundt's theories of the other phases and processes of consciousness. Wundt himself has given us an instance of one such change in his modification of the *Innervationsgefühl*. The *Thätigkeitsgefühl* could be interpreted in the same way — analyzed and defined, *e. g.*, in the way in which Külpe describes it,—and yet the rest of Wundt's theory of attention would be left undisturbed by the change. Indeed it seems to us that the whole discussion of apperception in the fourth edition of the "*Psychologie*" carries one on to a position where an "unanalyzable" feeling of activity has no place, and that Wundt himself has shown more clearly than anyone else that it is not necessary in order to explain the facts. It would have been, we think, more consistent with his own system, and more true to the facts, if he had recognized the "feeling of activity" as a feeling in the ordinary sense of the word—a concrete, complex phenomenon, including muscular sensations; the idea of activity, or of a self, reached by inference from the facts of consciousness; and, at the same time, the affective tone accompanying these sensations and ideas. Such a conception of the feeling of activity would complete the work Wundt has already carried so far, *i. e.*, an analysis of attention that shall combine the psychological data of the neo-Herbartian theorists and the physiological observations of the empiricists. On the one hand, Wundt records the psychological facts freed from any metaphysical implications; on the other hand, he proceeds on the assumption that physiological changes accompany all the conscious processes, and no theory is accepted unless it agrees with both series of facts so far as they are known.

The second factor in Wundt's account of the process of attention is that with which we are specially concerned in this chapter; attention is an inhibition of all impressions and memory-images except those attended to. This inhibition is the function of the frontal lobes—the so-called "apperception centre." The apperception centre is intricately connected with the other centres in the brain. An excitation passes from a sensory centre on to the apperception centre, and outwards along the motor path. The effect of the entrance of some particular excitation is the inhibition of the passage of all other excitations. In accordance with the law of the relativity of consciousness, the idea corresponding to the uninhibited excitation gains in clearness in proportion as it is freed from competition with other ideas. As the excitation

completes its course by the production of movements which are in harmony with the apperceived idea, these movements give rise to sensations akin to the idea. The motor adjustment causes "associative co-excitation," which may, and ordinarily does, intensify the original idea. Wundt describes this indirect reinforcement in the third and fourth divisions of his definition of the attention, and in that connection refers to it as a very frequent factor in attention, although not absolutely essential. If, however, such intensification of an idea is a secondary effect, we must ask whether there is any *direct* reinforcement of the sensory centre from the apperception centre. Wundt says:

"According to the general principles of central excitation, we could as well think here of an excitatory as of an inhibitory effect. . . . . But in view of the fact that increase of clearness, with which we are here concerned, is quite distinct from increase in the intensity of a sensation, the first of these suppositions has evidently little probability. In order to carry it out, we should have to conceive of the excitatory effect of these central processes as qualitatively different from other excitatory effects. This would contradict the principle of the uniformity of elementary functions, and it is also in opposition to the fact that the motor effects of the centre *A C* are just like other motor excitations. On the other hand there is nothing to oppose our regarding the effect of the apperceptive centre to be inhibitory. This inhibition, indeed, is not to be thought of as a *destruction* of certain excitations in sensory centres. It simply consists in the fact that in consequence of the excitatory effect of the signal stimulus, the entrance of other signal stimuli to the apperceptive centre is prevented. This fully harmonizes with our experience that the focus of attention narrows with its degree, and that, after repeated attention to certain ideas, the focus can extend so as to include more of these ideas."[1]

It is hardly necessary for us to state that Wundt is not maintaining the existence of an "organ" or "centre" of apperception in any form contradictory to the principles of localization presented in the first chapter. Wundt's account of the sense in which he uses such terms is so explicit that we need only refer to it without quotation.[2] He asserts nothing more than that the functioning of certain parts of the brain "is a necessary part of the physiological processes which accompany the intellectual functions."

It seems strange that after such an explanation of his position, Wundt should be accused by Münsterberg, Bastian and others of making attention a "faculty" and localizing this faculty in some part of the brain. Just as Wundt maintains that there is no "consciousness as such," but that there are "conscious states," or "conscious states and processes,"[3]

[1] *Op. cit.*, p. 276. See also p. 286.
[2] I, pp. 224-228, and II, p. 285.
[3] I, p. 226; II, p. 255; and "Lectures," pp. 236, 238.

so he would affirm that there is no "attention as such," but that there are "ideas attended to." And the changes in the ideas which constitute what we call "our attending," are accompanied by physiological processes; primarily, by processes in the frontal lobes; secondarily, by processes in other parts of the cortex, in the sense-organs, or in any part of the periphery. This is practically Wundt's position, and we do not see that it is touched by any criticisms directed against the localization of a faculty.

One difficulty, however, we do feel in an attempt to follow out Wundt's account of the action of the apperception centre. The description of the inhibitory action of the frontal lobes is very vague. A "signal-stimulus" enters, and all other stimuli are inhibited. How are we to conceive of this inhibition? "Inhibition" is itself an excitation, and some physiologists refuse to use the term except in referring to the action of certain excitations upon muscles. If, however, the term may properly be used in speaking of the interaction of excitations in the nerve substance, there is still much obscurity to us in the application of the process in order to explain the facts of attention. Wundt and Külpe pass over the matter too lightly. They should recognize the difficulties still left in the way, and either answer them, or state that they are unanswerable in the present state of our knowledge.[1] In fairness, however, we must recall the fact that they do refer to their use of inhibitory processes as somewhat hypothetical. The difficulties that arise are not merely such as are due to ignorance. The nature and extent of inhibition are subjects of investigation among neurologists at the present time; and occasionally, as we shall see later, the inhibitory nature of the frontal lobes is denied.

Before leaving the topic, we take up two questions raised with reference to Wundt's theory in a recent treatise, "*Zur Theorie der Aufmerksamkeit*," by H. E. Kohn. The consideration of the two objections will clear away certain misapprehensions that might obscure Wundt's real meaning.

The first objection is a charge of inconsistency in Wundt's references to the action of the frontal lobes. Dr. Kohn cites passages in which Wundt speaks of the action as "*eine hemmende Wirkung*," and others in which he speaks of it as "*erregende*."[2] But the apparent inconsistency is due to the two uses of "*erregen*." It may be defined so as to include inhibition, or so as to stand in contrast with it,—either referring to excitation in general or to adjuvant excitations. With

[1] See below, p. 41 and note.
[2] "*Zur Theorie der Aufmerksamkeit*," 1895, pp. 42, 43.

this in mind there seem to us to be no contradictions in the passages quoted.

The other objection raised by Dr. Kohn maintains that Wundt's theory fails to account for any increased clearness in an idea. "The 'signal-stimulus' has only this effect, that the energy of the apperceptive centre released by it merely inhibits other 'signal-stimuli.' We do not see what the original stimulus gains from the signal-stimulus which calls it forth, and from the apperceptive process which it excites. If the stimulus reaches the sense centre, it experiences absolutely no change through the apperceptive process."[1] Wundt's answer to this would probably be that clearness and intensity are known relatively, not absolutely. If competitive stimuli are absent, the stimulus present is relatively clearer, and it is also the more likely to be intensified by the "secondary effects" already described. Külpe states the case rather more clearly than Wundt: "If we accredit attention with inhibitory functions only, the peripheral and central excitations and their relations, if they can secure free and unimpeded recognition in consciousness, produce all the phenomena which characterize the state of attention, of their own power and by their own laws; and the function of apperception consists simply in the suppression of competitive activities."[2]

We have discussed the first and second of the four part-processes which Wundt includes in attention. In the course of the discussion we have had to refer occasionally to the last two processes, since they are the source of the increase in intensity frequently accompanying attention, and since this intensification is the ground for the consideration of attention as a reinforcing process. Partly because they have been already referred to, and partly because they are recognized to be of more or less importance by every theory of attention, we need give no further consideration here to "the muscular strain sensations, with their attendant feelings," or to "the intensifying effect of these strain sensations on the sensory contents of the apperceived idea through associative co-excitation."

B: Külpe's theory. Külpe's theory of attention, in so far as the importance of inhibition is concerned, is much the same as Wundt's, but it discusses more fully the relation of attention to other processes, it emphasizes more distinctly certain factors, it rejects Wundt's first factor, and it recasts Wundt's material into quite a different form. We shall only

[1] *Op. cit.*, p. 42.
[2] "*Grundrisse der Psychologie*," 1894, § 76, 4; Eng. tr., p. 444.

consider these differences in so far as they may possibly offer some further explanation of attention.

The best "explanation" is often a well-ordered description of the facts in their observed relations. Hence, we consider first the order of Külpe's treatment. After defining attention as a *state of consciousness*, he describes its effects, the phenomena which accompany it, its conditions, and lastly the theory of attention, "the determination of the essential factors in attention itself."[1] The term "effects of attention" is applied to "the changes which conscious contents undergo in the attentive state."[2] These changes are an increase in sensitivity and sensible discrimination; greater liability and fidelity of reproduction; the disappearance of feelings when attended to as such; a greater ease in the analysis of fusions; the concentration of consciousness; the more rapid rate of perception or reaction.

The section on "the phenomena of attention" describes the phenomena regarded by Ribot as constitutive elements, but by Külpe as concomitants, characteristic, but not essential to attention. Some of these are changes in respiration and in other bodily movements, central and peripheral hyperæmia, centrally excited sensations, adaptation of the sense organs, and sensations of strain.

By "conditions of attention" Külpe means "the incentives which lead to the appearance of particular contents in the attentive state."[3] The conditions are divided into two classes, external and internal. The external include those motor and sensory changes which direct, or tend to direct, the attention upon certain impressions. The internal conditions are: the affective value of the impression, and the relation of the impression to the psychophysical disposition; including (α) the associative relations of the impression to the ideas already in consciousness, (β) its relations to the materials of reproduction, and (γ) the relative vacancy of consciousness.

The last section, on the "theory of the attention," is "a determination of the essential factors in attention itself." A large part of the section is negative, presenting a refutation of three views of attention: that which regards it as nothing else than an increased intensity of sensation; that which maintains that attention is "an emotive state translated into terms of motor energy" (Ribot), and that which explains attention in purely psychological terms. As the criticism of this last view leads up to Külpe's own theory, we must spend a little time upon it.

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[1] *Op. cit.*, § 76, 1.
[2] § 73, 1.
[3] *Op. cit.*, § 75, 1; tr., p. 437.

"An explanation of the attention in purely psychological terms, such as has been attempted, *e. g.*, by Herbart, obliges its adherents to ascribe a determining influence to the unconscious as a psychical process, if not to make it the one primal force in mind. For there can be no doubt that the most essential conditions of the origin and maintenance of attention must be sought outside of consciousness. The evidence on this point is overwhelming. The force of attention is wholly unintelligible on any other hypothesis; it is a frequent experience that the incentive to the preference of a content by apperception does not come to consciousness; and individual variation of the capacity of attention in normal subjects, as well as the differences observed in pathological cases, put the assumption of definite physiological conditions of a central character beyond the range of question."[1]

In accordance with the opinion just quoted, that the most essential conditions of attention must be sought outside of consciousness, Külpe maintains that the essential function of attention is to inhibit. Neither the mechanism of inhibition nor the inhibitory process, however, is conscious.

Our chief objection to Külpe's treatment of the attention is his inconsistency in defining attention as "a state of consciousness," and yet refusing to recognize any factor as *essential* except the unconscious, purely physiological process of inhibition. Every psychophysical theory involves some physiological correlate, but that this process *constitutes* attention, and that all the psychological phenomena are secondary, we deny. Külpe, however, does not arrive at his conclusions without consideration of the psychological changes that have been regarded by others as essential factors of attention, and before any elaboration of our objections to his position, we shall quote from his own argument against theories of the psychological type, selecting, above all, those passages which criticise Wundt's opinion that increased clearness of an idea is an essential.

"Introspection discovers nothing really new in attention, nothing which is characteristic of the process as such. . . . When we find the increased clearness of a perception or the increased vividness of a sensation or conscious concentration upon one or two definite ideas, interpreted as functions of attention, we must reply that while all these changes appear in the attentive state, they are always changes in the conscious contents, and cannot be conceived of as separated from them. It is, therefore, altogether impossible to add all these changes together and account them a specific process, and to give this process the name of attention in contradistinction to the particular contents; for every item in the sum proves to be . . . . nothing more than a purely quantitative process, which may be set up in consciousness by other means than that of attention. The reader may incline to find a possible exception to this in the clearness of the quality, difference, etc., in the state of attention. For clearness or distinctness is certainly not identical with the intensity of an impression. . . . Now distinct-

[1] *Op. cit.*, § 76, 3; tr., p. 443.

ness is partly referable to conditions in the sense organ. . . . . But, this apart, we mean by the term simply the relatively most favorable apprehension of an impression, as expressed in a relative maximum (α) of its discriminability from other contents, and (β) of the liability of reproduction of its attributes. It follows, of course, that clearness or distinctness is not a new character, which can be detached from the particular contents to which it is ascribed, and constituted the predominant factor in attention."[1]

There are two lines of thought here. With one of them we entirely agree; *i. e.*, with all that Külpe has to say of attentive changes as "purely quantitative," introducing nothing that can be "conceived of as separated from the conscious contents," or considered "in contradistinction to them." We agree also with his analysis of clearness. But it does not follow that clearness cannot constitute the predominant factor in attention; nor is it true, in our opinion, that clearness can be "set up in consciousness by other means than that of attention." Külpe is ignoring here the facts of "passive attention." All that he says in this passage only goes to show that attention is a relative state, and is always present in some degree in our conscious life. Even in that dim region which Wundt refers to as lying above the "limen of perception" and below the "limen of apperception," it does not seem to us that clearness, distinctness, attention, or, in other words, apperception itself, is wholly absent. There is a difference in degree, which appears to be a difference in kind when considered in its relations to memory, language, or practical and experimental uses. But when we consider conscious facts apart from such relations, we cannot see that there is any absolute separation in consciousness of consciousness as such, and attentive or distinct consciousness.

Our own modification, then, of Külpe's theory would be the elimination of the increased clearness of a perception, in its two-fold definition quoted above, from the section on the "effects of attention," and its introduction into the section on the theory of the attention as a constitutive factor of the state. The question as to whether the essential physiological factor is inhibition must still be left open, at least until the evidence in favor of other theories has been more carefully considered.

III. *Theories of attention as combined facilitation and inhibition.* We have reviewed the theories which attempt to explain attention as a central reinforcement, and central inhibition of ideas. We now turn to a theory which holds that neither of these alone gives an adequate explanation of the facts, and maintains that attention must be both a reinforcement and

[1] *Op. cit.*, § 72, 2; tr., pp. 424, 425.

an inhibition. The chief exponent of this theory is Exner. He enters into the subject from a physiological standpoint, with an intimate knowledge of the nervous system and its processes. It is impossible to do justice here to Exner's construction of a physiological basis for his theory of attention. We have quoted in our introductory chapter the evidence he adduces in favor of the new concept of *Bahnung*. But his systematic application of this and of more familiar concepts cannot be properly valued without a careful review of the work as a whole. Obscurities in our summary of his theory will be removed, we think, by reference to the chapters preceding that on attention, in which Exner describes and schematizes the nerve processes correlative to the more elementary processes of conscious and unconscious movement. We, however, can attempt to present here only those portions which stand in immediate connection with the explanation of the peculiar and distinguishing characteristics of attention itself.

Of all the sections preceding the chapter on attention, that which deals with reaction times (pp. 156-162) seems to us to stand in closest connection to the subsequent definition of attention, and as a preliminary to the citation of that definition, we quote the author's explanation of the motor type of reaction.

> "There can scarcely be a doubt that this form of a typically voluntary movement is to be referred to the fact that the intention (*Willensintention*) to execute a definite movement as quickly as possible upon the appearance of an expected sense stimulus, depends upon a change which the cortical processes bring about in the relations affecting the excitability of sub-cortical centres. . . . The reader will at once recognize the similarity between the relations here described and those already mentioned in the account of *Bahnung* [quoted in our first chapter] and of the regulation of voluntary movement by ideas [pp. 151-154]. In fact it was through the investigation of reaction times that I was led to believe in the existence of the phenomena which I have described above under the name of phenomena of "facilitation," and for which I later found proof in experiments on animals."[1]

If we bear in mind, then, that voluntary action is to be thought of as "a change which cortical processes bring about in the relations affecting the excitability of sub-cortical centres," and that this change is referred to as either a facilitation or an inhibition, or both, we have the two most important ideas involved in the definition and explanation of attention. Exner states the definition in these terms:

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[1] "*Entwurf zu einer Phys. Erklärung der Psychischen Erscheinungen.*' p. 158.

"We have shown that an act of will can bring about changes in our nervous system, the effect of which is that an excitation now follows a path *A*, and now, when a different change has been voluntarily set up in place of the former, takes the path *B*. The changes thus set up have the character of states. I see in this interaction of different parts of the nervous system the essence of what we ordinarily call attention."[1]

Exner's schemata are so serviceable in the course of his explanations that we reproduce here the "schema for the demonstration of the effect produced by the direction of the attention to sense-impressions." And we quote from the context the passages that give the substance of Exner's explanation and application of the schema.

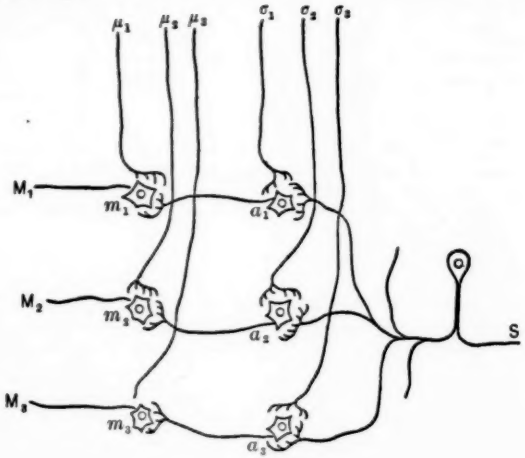


Fig. 48.

"If we apply the diagram to the case of the motor form of reaction when only the group of muscles represented by M_1 is to contract, then we must think of the cell m_1 as being charged through μ_1; and perhaps also the cell a_1 is charged through σ_1. Then when the stimulus enters through *S* it will pass through a_1 and m_1 to M_1. In this instance the paths facilitated lie in the sub-cortical centres. Similar changes can take place in the cortex, as we shall see later."[2]

"But attention can also be applied to the stimulus entering through *S* without being connected with a tendency to movement, as when, for example, some particular part of an object interests us. The physiological state of attention then consists in a charging of the *a*-cells through the *a*-fibres. [These *a*-fibres will carry excitations both to and from the cortex: *e. g.*, pp. 153, 155 and 164.] A feeble excitation by way of *S* will then bring these cells to the point of

[1] *Op. cit.*, p. 163.
[2] P. 163 (paraphrase).

discharge; and if the charging is still kept up through the *a*-fibres, the *a*-cells will remain in continuous excitation until they, or the central terminations of the *a*-fibres, or both, are exhausted, — in which case we speak of fatigued attention."[1]

"But although attention *may* thus be exclusively sensory, 'it will probably be found, in accordance with the diagram, that there must be a *tendency* to movement in sensible attention, since the *m*-cells receive stronger impulses than when the *a*-cells are not charged; impulses which are stronger before as well as at the time of the entrance of the sensation. . . . Introspection shows that at least those muscles whose region of innervation is nearly related to the sensory region concerned can scarcely be kept at rest if the attention is directed to the corresponding sensations.'"[2]

Examining the physiological phenomena of attention more closely, we find that "whether the attention is turned to sense-impressions or movements or memorial images, it always causes certain paths of the nervous system to become specially practicable *(fahrbar)*, and to remain in this state a longer or shorter time; and, furthermore, reduces the conductive power of a great number of other paths. The more intensive the attention, the lower is the excitability of these other paths. . . . I will designate this total state of the system by the term *Attention* [not *Aufmerksamkeit*], and accordingly speak of attentional inhibition and attentional facilitation. The dividing line between them may have to be drawn at very different points in different sense departments if we choose to venture on comparisons of department with department, and will certainly vary from case to case with the disposition of the whole nervous system."[3]

Exner's definition of attentional inhibition is rather perplexing. He says, "By the term attentional inhibition, I mean a state of the centres somewhat like that which prevails in a reflex organ or in a centre subserving instinctive movements,—a centre which is stimulated to action by an adequate stimulus but prevented from acting by the will. I mean, *i. e.*, an increased tonus of the cells, in spite of which discharge is obstructed. And this region of simultaneous facilitation and inhibition may be variable."[4] Since Exner's concept of the will is a thoroughly psychophysical one, the statement quoted cannot mean what on the surface it seems to mean. The passage must be interpreted in the light of his general treatment. The last sentence of the quotation shows that here, as elsewhere, attentional inhibition and facilitation are being considered together as coöperative and complementary processes. To make the passage at all intelligible or consistent, we have to paraphrase it in the following fashion. If we attend to an object there may be a rise in the tonus of a region *a*. This region may now be compared to that connected with a reflex organ in which there is a permanent "facilita-

[1] P. 164.
[2] P. 164.
[3] Pp. 165, 166.
[4] P. 166.

tion" of discharge in certain directions. In both cases there is a tendency to discharge, but actual discharge will be prevented if there is at the same time an attentional facilitation of some other region. Exner might also refer here to his account of the inhibition of *motor* phenomena in the passage already quoted from pp. 163 and 164. But apparently he thinks of that as so exceptional that after once stating its possibility, he makes no further use of it. And with this exception he always refers to attentional inhibition as attendant upon and simultaneous with attentional facilitation.[1]

The most important point with regard to attentional facilitation is the relation of attention to the intensity of a sensation. As Exner says, "From the preceding explanation we might expect the intensity of a sensation to increase as the attention was more fully directed upon it. As a matter of fact, if the cell σ_1 (Fig. 48) is charged, and at the same time receives impulses through the fibre σ_1, the retroactive excitations must be greater than if σ_1 had carried no impulses to a_1. In other words, the intensity of the intercellular tetanus (see chapter II, p. 94) depends upon each of the coöperating factors."[2] We recall at once the conclusive objections against the consideration of attention as nothing else than an increased intensity of sensation so concisely stated by Külpe.[3] But Exner's further development of his theory shows that it is not touched by the objections stated by Külpe. For although he holds that attention does increase the intensity of a sensation, he also maintains that there is a recognizable difference in consciousness between the enhancement due to increase of stimulus and that which results from increase of attention. Another diagram will give his idea more exactly.

The accompanying statement is as follows:

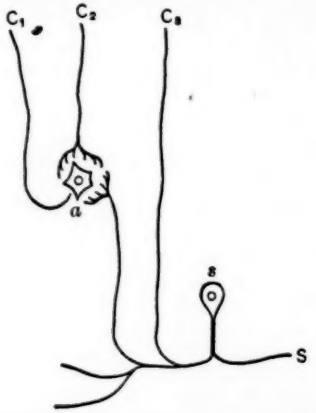
"Nevertheless, the excitations which reach the organ of consciousness will be different according as the external stimulus, or the attention, is increased. And if they are different, the two cases will be distinguished in consciousness. Let a represent a cell through which impulses of attentional facilitation, following the path C_1, flow from the organ of consciousness toward s; and let there be, running from s to the cortex, the other path, C_2, which has occurred so often in our previous figures. There will then be an intercellular tetanus established between a and s. The impulses given off from a may be diffused along several paths; we are ourselves concerned with the further path C_2, which may also give occasion to a conscious sensation.

[1] Notice that this statement holds only with regard to *attentional* inhibition. It does not refer, of course, to the purely physiological inhibitions described in Exner's second chapter, pp. 71-76.

[2] P. 168.

[3] "Outlines of Psychology," § 76, 1; tr., p. 441.

"Now when we consider the diffusion experienced by every excitation that penetrates the gray matter, due to the ramification of its paths, we cannot doubt that conscious processes may be aroused by the stimulation of S by way of C_3 as well as by way of C_2, and probably also by way of C_1. There is just as little doubt that in case of simultaneous facilitation by way of C_1 . . . the relation between the impulses flowing into the organ of consciousness by way of C_2 and C_3 is altered. There are at least no reasons for assuming that the relation remains the same, while there are many for supposing that it undergoes a change (cf. p. 58).



"In other words, if C_3 conducts an excitation of a certain intensity to the cortex, and at the same time C_2 conducts one of much less intensity, we have *one* total impression. If C_3 conducts an excitation of the same intensity as in the first instance, and C_2 another of greater intensity, then we have *another* total impression. These two impressions must therefore be distinguishable in consciousness, just as according to the modern theories of color-vision the impression of red-orange is distinguishable from the impression of yellow-orange owing to the relatively unequal excitation of the same kinds of fibres."[1]

Exner gives two illustrations to show how this theory explains the facts "in the domains of sensitivity and motility." The first instance is an application of the schema to the fact that we have a sensation of blackness when there is no excitation of the retinal elements. The second instance is an explanation of the apparent movements of objects when the motor apparatus is rendered incapable of functioning.[2]

Exner further limits the influence of attention to processes accompanied by consciousness. Sense impressions have,

[1] Pp. 168, 169.
[2] Pp. 169, 170.

therefore, been "worked over" once at least before they can be modified by attention.[1] This is one reason for the high degree of accuracy of mere "impressions," or of judgments with regard to sensations inattentively experienced.

To conclude our summary, we may quote the closing paragraphs of the chapter on attention:

"I must not omit to emphasize the fact that I do not assume the processes of attentional facilitation here described merely for cases where the attention is intensively directed upon its object. I believe, on the contrary, that no central function ever wholly disappears; that a certain degree of excitation (which I have repeatedly referred to, in contradistinction to intercellular tetanus, as the tonus of the cells) is always present; that the degrees of this tonus vary; that its magnitude is primarily dependent on excitations that run their courses along related paths; that in connection with these, phenomena of inhibition and facilitation may appear, etc. . . . . But the more intensively the attention is applied to one complex of paths, the more it is withdrawn from the rest."[2]

We pass now to a consideration of the comparative validity of Exner's theory of attention. We recognize that in any attempt to evaluate theories representing the life work of men who are recognized as authorities, we are treading on dangerous ground. Any judgment must be a merely tentative one;—indeed it can hardly be called a judgment, — it is rather an investigation of the ground of the differences in the theories and a statement of the alternatives offered in the acceptance of the one or the other.

It is evident that the fundamental concept in Exner's theory is that of coördinated facilitation and inhibition, and of these two processes we are concerned only with the member which other theories of the day reject—facilitation. Exner treats of facilitation first as a purely physiological process, and secondly as a process involved in attending. What he had to say under the first rubric we have quoted in our first chapter. We suspended comment there in order to review the theory as a whole before criticising any part of it. As we return to it now, the account of the various experiments on animals seems to us to be an account of facts known before presented here under a new name. Certainly we knew that there was interaction between nuclei connected with groups of muscles assuming a single function, or closely related functions. But these nuclei are in close anatomical connection. If *Bahnung* means simply that nerve currents in the same organ, or in organs with close and definite anatomical connections, can reinforce each other, then it is no new concept. We think the whole subject would have been clearer if Exner had stated

[1] Pp. 166, 167.
[2] P. 171.

this himself, and then given his reasons for emphasizing and further illustrating by experiments of his own facilitatory interaction of certain nuclei of the nervous system. It seems to us that he emphasizes the experimental proof of this interaction in the nervous system of animals because he wishes to extend the concept further to cases where there is no direct, intimate anatomical connection, and the facilitating process is accompanied by consciousness. To this extension of the concept he gives the name of "attentional facilitation," our second subordinate topic. Having accepted the first, the purely physiological concept of *Bahnung*, what have we to say to this extension of it to activities accompanied by consciousness?

In the first place we must recognize that facilitation in attention is as yet only an hypothesis. Exner would doubtless admit this, for he refers occasionally to the hypothetical nature of his explanations (*e. g.*, p. 87). At the same time he maintains that the hypotheses advanced are those which are in closest correspondence with our knowledge of the physiology of the nervous system. From this standpoint there are many facts to render probable the hypothesis of attentional facilitation. (1) All nervous impulses are recognized from the outset to be both excitatory and inhibitory.[1] (2) No more intimate connection of the cortex with other parts of the nervous system needs be supposed for combined facilitation and inhibition than for inhibition alone. (3) The brain centres certainly "work over" incoming currents in some fashion, and there is no reason apparently *against* the assumption that their energy may reinforce that of the incoming current, while Exner shows that there are many reasons *for* the supposition. (4) Moreover, in many cases where two organs function together, the limen of their common discharge is lower than the limen of either alone, when the two are separated. In these cases "facilitation" may mean either the lowering of the limen of discharge or the reinforcement of a nerve current. For these reasons among others, the concept of *Bahnung* is valid from the physiological standpoint.

The crucial point in the psychological application of *Bahnung* is found in Exner's assertion that attention increases the intensity of a sensation, but that increase of intensity due to attention is recognized as different from increase of intensity due to the stimulus. Wundt and Külpe also recognize, as indeed every one must, that the intensity of a sensation ordinarily increases in attention, but they ascribe the increase to "associative co-excitation." They deny that attention di-

[1] *E. g.*, Wundt, "*Phys. Psych.*," I, pp. 252, 258.

rectly intensifies a sensation. Exner admits the existence of associative co-excitations, but ranks them as secondary phenomena, and finds them insufficient to account for the facts of attention. When psychology has obtained better experimental control of attention, test-experiments may be devised to decide between the theories of Wundt and Exner. At present, we can make no absolute decision. If we accept the theory of Wundt and Külpe that attention is purely inhibitory, we must explain the increased clearness and efficiency of an idea primarily by the law of the relativity of consciousness, and secondarily by associative co-excitation. At the same time we have no satisfactory schema for the process of inhibition itself.[1] If we accept the theory of Exner that attention is both inhibitory and facilitatory, we explain the increased clearness and efficiency of an idea by correlating them with the facilitatory processes, while at the same time the absence of unrelated ideas is ascribed to coöperative inhibitions; we maintain that attention intensifies sensations, but that intensification due to attention is recognizably different from intensification due to increased stimulus. Both theories must acknowledge that attention does actually reinforce some ideas while it inhibits others. Any instance of close attention in daily life is a picture of the two processes combined. But Exner regards the reinforcement or facilitation as equally fundamental with the inhibition; or rather, throughout his discussion he refers to facilitation as the more fundamental process, preceding or occasioning an inhibition of unrelated regions. Wundt and Külpe reverse the order of the two processes, and, moreover, deny that there is any direct facilitation by central processes; all reinforcement must come by way of associative co-excitation. Neither side has final and completely satisfactory proof for its position; and until we know more of the physiology of the central nervous system, the question whether attention is primarily facilitation or inhibition must be left open.

The conclusions reached by Bianchi, in his recent study of "The

[1] We notice a similar criticism of Külpe's treatment of inhibition is made by Meumann in *L'Année Psychologique*, 1894, p. 514. He says: "I cannot share the opinion of the author that inhibition may be regarded as an independent process. We can think of the inhibition of physical or psychical processes only as the *negative* side of another process. We can only suppose that the energy of one part of the brain is lessened because some other part is expending a surplus of energy. Inhibition, then, does not explain the clearness of a sensation, but just the reverse is true: we interpret the appearance of inhibition in one part of the nervous system as a consequence of the expenditure of too great energy in another part."

Functions of the Frontal Lobes,"[1] must be taken account of in any attempt to explain attention by means of inhibitory or facilitatory processes in the frontal lobes. Bianchi's experiments were performed upon twelve monkeys and six dogs. All the operations were successful except two, and the animals were kept under observation for months or even years. The skill and care with which the whole work was performed cannot be called in question. For his conclusions, Bianchi makes no greater claim than that they give "a plausible explanation of the phenomena observed. . . . . I feel, at any rate, certain of the accuracy of the observations themselves."[2] On the basis of these observations he states very positively that "the frontal lobes are not centres of inhibition. . . . Without attempting to go fully into the theories concerning inhibition and its centres, it will be granted that inhibition depends upon a general psycho-physiological process, and that every part of the nervous system becomes, under different circumstances, either an inhibitory or an inhibited centre. . . . Physiology and psychology swarm with facts showing the error of those who assume a special cortical centre for inhibition."[3]

One statement in this connection we must object to. "We may ask ourselves whether there exists really any centre the function of which is to inhibit, hence whether there exists a faculty of attention. I reply distinctly, No."[4] The "hence" in this sentence is obviously a *non sequitur*.

Bianchi's own "hypothesis is that the frontal lobes are the seat of the coördination and fusion of the incoming and outgoing products of the several sensory and motor areas of the cortex. . . . The frontal lobes would thus sum up into series the products of the sensori-motor regions as well as the emotive states which accompany all the perceptions, the fusion of which constitutes what has been called the *psychical tone* of the individual. . . . With the organ for the physiological fusion which forms the basis of association, disappear also the physical conditions underlying reminiscence, judgment and discrimination, as is well shown in mutilated animals."[5]

Bianchi's general description of the rank and influence of the frontal lobes agrees with that given by Wundt, but their characteristic physiological process is said to be one of coördination and fusion instead of a process of inhibition. This tallies with Exner's definition of *Bahnung*, and it seems at first sight to add much to the probability of Exner's theory. The inhibitory theorists, however, would doubtless maintain that Bianchi misinterprets their concept of inhibition. They could agree with him in regarding the frontal lobes as necessary for the fusion of impressions, and yet explain the relation between the two by assuming that the fusion of certain impressions is possible only when there is inhibition of all other impressions. It must also be remembered that Bianchi's experiments were made upon animals that had already had the use of their frontal lobes for some time. Many of the phenomena that persisted after their removal must have been at some earlier time dependent upon the functioning of the frontal lobes, so that conclusions must be drawn very carefully. Yet, after all due allowance

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[1] *Brain*, Part LXXII, 1895, pp. 497-522.
[2] Pp. 519, 522.
[3] Pp. 520, 521.
[4] P. 520.
[5] Pp. 521, 522.

has been made for these two objections to Bianchi's summary disposal of the inhibitory function of the frontal lobes, it still seems to us that his observations tend to overthrow the theory of the purely inhibitory character of these functions. The animals operated upon performed all simple acts in a wholly normal way. With regard to higher functions, they were passive, and unresponsive to stimuli that formerly had excited their higher activities. It is hard to see how such results can be fully explained on the hypothesis that the *sole* function of the frontal lobes is inhibition.

Our restriction of the term "explanatory" to the three types of theory discussed in this chapter leaves us open to the criticism of those who maintain that attention is primarily the direct result of variations in peripheral organs. In answer to the criticism we would say: (1) that the only completed theories of this order are those of Ribot (in so far as he considers attention as essentially motor) and Münsterberg. These have already been reviewed in the preceding chapter; and although each has made positive contributions to our knowledge of the phenomena of attention, it is evident that neither goes far enough to be called an explanation. A third attempt is being made by Dr. Heinrich of Zürich, but at the date of our writing only the first chapter of his work has been published.[1] Moreover, references in an earlier work show that Dr. Heinrich admits the probability of the dependence of attention upon central factors. ("*Die moderne physiologische Psychologie*," pp. 129 and 232.)

CHAPTER IV.

Attention and Distraction: An experimental investigation of the effect of so-called distractions on sensible discrimination.

In the preceding review of the current theories of attention frequent reference has been made to the relation between changes in attention and changes in the intensity of a sensation. At one time attention was frequently taken to be the same thing as an increased intensity.[2] Later it was maintained that attention only *indirectly* heightened the intensity of sensations.[3] Others, again, have regarded the intensification as an essential part of the process of attention, but not the whole process; and, moreover, the intensification due to attention is said to be recognizably different from that due to increase in the intensity of the stimulus.[4] Still a fourth

[1] Ebbinghaus' *Zeitschrift für Psychologie und Physiologie der Sinnesorgane, Bd.* IX, *Heft* 5 *u.* 6, *S.* 342-389.
[2] James Mill, etc.
[3] Wundt, Külpe, etc.
[4] Exner.

opinion holds that attention has an opposite effect, and that "all stimuli appear relatively less when the attention is directed to them from the outset." This view has been advanced by Prof. Münsterberg as the outcome of a series of experiments made in the Harvard laboratory and published in the *Psychological Review*, Vol. I, January, 1894, pp. 39-44. Prof. Münsterberg speaks of his conclusion as "an unexpected result." It seemed to us not only an "unexpected," but also an unexplained result. The published account raised many most important questions, to which it gave no answer. The conclusions drawn by the author could not be accepted on the evidence given. There seemed to be a good opportunity for other interpretations of the numerical results. But no one would be competent to judge between different possible interpretations without repeating the experiments. Since the question was one of great significance for any theory of attention, it clearly demanded further investigation. And it was evident that the first step in our investigation must be a critical examination of Prof. Münsterberg's results, on the basis of a careful analysis of the same and similar experiments. Should our results coincide with his, we should then be in a position to decide independently whether they confirmed his conclusions or seemed to be more reasonably explained through factors not noticed in the original experiments. And if our results should materially differ from those obtained by Prof. Münsterberg, this fact would only emphasize the need of a more careful and complete analysis of the factors included in the experiments.

We may here anticipate our account of our results far enough to state that the greatest value of the experiments seemed to us to lie in their bearing upon a problem not mentioned by Prof. Münsterberg,—the problem of the nature and degree of the distraction employed in order to secure inattention. No one can answer the question of the intensifying effect of attention, on the basis of these experiments, until he has first secured some reliable source of distraction, or some method of measuring the degree of distraction obtained. We think that these particular experiments have no conclusive answer to give to the problem of "the intensifying effect of attention"; but as material for the analysis of so-called "distraction" they have been valuable and suggestive. Accordingly our criticisms and conclusions have been grouped together under the heading of this chapter, "Attention and Distraction."

We shall give (1) a brief account of our own experiments, (2) a comparison of these results with Prof. Münsterberg's, together with a statement of our criticisms and conclusions,

and (3) a discussion of the sources of error discovered, and of the precautions suggested by our study of these errors.

I. *Account of our own experiments.*

In general, Prof. Münsterberg's directions were followed out. The one important exception was a difference in the relative intensities of stimulus used. It seemed to us that the difference judged should be somewhere near the limen of differences; for the object of the experiments was the discovery of a tendency to overestimate or underestimate stimuli under certain conditions, and unless the differences given are comparatively near the limen of difference, the tendency, though it may be present, may give no evidence of its presence in the judgment. We found that in the series with weights, distances and light stimuli, the larger differences used by Prof. Münsterberg were correctly judged by our subjects with such ease and certainty, both when their attention was free and when it was distracted, that these differences were eliminated from the series. The change would inevitably have made any tendency to overestimate or underestimate stimuli more clearly evident in our numerical results than in Prof. Münsterberg's, had any such tendency been present.

Minor variations in the experiments, such as slight changes in the intervals of time or in the manipulation of the apparatus, will be mentioned in connection with the special series in which they occurred. The general directions for the experiments we give in Prof. Münsterberg's words:

"Our problem was to arrange the experiments in such a manner that the intensities of two impressions of moderate strength could be compared, and at the same time the attention be directed toward one and away from the other. In this way we examined intensities produced by light, sound, and the lifting of weights, and also the distances between visible points, the distances serving as measures for the intensity of the sensations produced by the movement of the eyes. The method always employed for diverting the attention was as follows: The subject was directed to give his attention fully to the adding of numbers, which in the case of optical impressions were read to him, and in the case of the auditory impressions were read by him. The adding took place before and during the time the stimulus was present. Since the order of the stimuli to be compared is of great influence upon the judgment, two sorts of experiment were arranged for each series. In one case, the attention was directed to the first stimulus, while the second was perceived with diverted attention; and in the other case, the attention was directed to the second stimulus, while the first was perceived with diverted attention. In order to discover from these series the influence of the attention, independently of other conditions, both series must be compared with the results of experiments in which the attention was either directed to both stimuli, or turned away from both. If we designate attention to the first stimulus by A, and that to the second by A^1, and, correspondingly, the inatten-

tion by I, I^1, we have then for each sense and for the same magnitude experiments with A-A^1, A-I, I-A^1, and I-I^1."[1]

We have, then, four sets of results: (1) for visual distances, (2) for light, (3) for weights, and (4) for sounds.

Visual Distances. "The optical distances were given by an apparatus consisting of a black cloth surface, 80 cm. square, upon which were two white points. The vertical distance between these points could be changed by a screw upon the back of the screen and the exact distance moved could be accurately read."[2] The subject opened his eyes at a signal; looked at the points for 3 sec.; at a second signal closed his eyes for 5 sec., while the distance between the points was being changed; at a third signal opened his eyes again, and looked at the points for 3 sec. In every instance a distance of 30 cm. was compared with 28.5, 29, 29.5, 30, 30.5, 31, or 31.5 cm. In half of the experiments it preceded the other member, and in half followed it. It was most frequently compared with 29 and 31 cm., and least frequently with 28.5 and 31.5 cm. The series were not precisely the same for the different subjects in any one of the four groups of experiments, since their ability to discriminate varied considerably; but the same series were used for each subject under all four sets of conditions. We had four subjects and made 400 experiments with each. The following table gives the numerical results:

TABLE I.—*Visual Distances.*[3]

SUBJECT.	A-A^1.				A-I^1.				I-A^1.				I-I^1.			
	Second stimulus correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.
P.	63	29	8	21	69	26	5	21	79	12	9	3	67	20	13	7
W.	66	27	7	20	62	28	10	18	67	24	9	15	73	31	7	16
R.	66	16	17	−1	58	27	15	12	66	17	16	1	76	11	12	−1
M.	66	23	11	12	71	19	10	9	66	24	10	14	68	16	16	0

[1] "The Intensifying Effect of Attention," *Psych. Rev.*, I, pp. 39, 40.

[2] P. 40.

[3] The results in all our tables are given in percentages of the whole number of experiments in each separate series.

We postpone the discussion of these numerical results until we have given the results of the experiments with the other stimuli.

Light. For the light stimuli two rotating disks were used with variable black and white sectors. The time intervals given were the same as in the preceding group. The darkest gray was produced by a black disk with a white sector of 65°, the lightest by a disk with a white sector of 115°. In each instance the subject was given differences of 5°-15° to judge, and care was taken that the number of cases in which the second disk was lighter should equal those in which it was darker. We have results from four subjects, and from 320 experiments given to each subject.

TABLE II.—*Light Stimuli.*

SUBJECT.	*A-A*¹.				*A-I*¹.				*I-A*¹.				*I-I*¹.			
	Second stimulus correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.
P.	80	12	8	4	70	11	19	−8	81	9	10	1	75	13	11	2
W.	73	19	8	11	66	11	23	−12	69	17	14	3	75	15	10	5
R.	75	12	13	−1	85	10	15	−5	88	4	8	−4	74	13	13	0
H.	74	13	13	0	80	8	12	−4	78	22	0	22	75	17	8	9

Weights. "The weight was given by lifting a funnel-shaped vessel, held between the thumb and first finger. The elbow rested upon the table, and the weight was raised without movement of the wrist. Weights were put into the funnel in such a way that they could be easily changed."[1] The funnel was lowered into the hand, steadily lifted and lowered, and after 5 sec. lifted and lowered again, but with the weight changed. A weight of 300 gm., including of course the weight of the funnel, was compared with an equal weight and with weights 10, 20 and 30 gms. heavier and lighter. With one subject, *V.*, differences of 50 gms. were used. Five subjects tried the experiments with weights. Each gave 400 judgments, 100 in each series.

[1] P. 41.

TABLE III.—*Weights.*

SUBJECT.	*A-A*¹.				*A-I*¹.				*I-A*¹.				*I-I*¹.			
	Second stimulus correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimat ion.
P.	71	16	13	3	70	25	5	20	78	11	11	0	71	21	8	13
W.	77	16	7	9	64	29	7	22	71	19	10	9	71	20	9	11
R.	69	28	3	25	62	20	18	2	62	37	2	35	71	15	14	1
V.	55	43	4	39	62	34	4	30	64	34	2	32	63	34	3	31
A.	71	25	9	16	63	25	12	13	61	34	5	29	61	27	12	15

Sounds. The sound was made by the striking of an ivory ball upon an ebony plate. "The ball was held by an electro-magnet and fell at the breaking of the current. The time between the two sounds was 5 sec. The normal height of the fall, 50 cm., was compared with 35, 40, 45, 50, 55, 60 and 65 cm. A signal preceded the sound, and simultaneously with this the adding of the numbers began as they were read."[1] These experiments were tried by two subjects who had had the practice of all the preceding series. Each subject completed four series of 80 experiments, 320 in all.

TABLE IV.—*Sounds.*

SUBJECT.	*A-A*¹.				*A-I*¹.				*I-A*¹.				*I-I*¹.			
	Second stimulus correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.	Correctly judged.	Overestimated.	Underestimated.	Preponderance of overestimation.
P.	73	15	12	3	78	12.6	9.4	3.2	74.7	13.8	11.5	2.3	72	16	12	4
R.	70	17.5	12.5	5	66	21	13	8	77.5	10.5	12	−1.5	70	18.8	11.2	7.6

[1] *Op. cit.*, p. 41.

The first result to be noticed is that out of the fifteen cases *only two* show the highest percentage of correct judgments in the series without distraction. In six cases the maximal accuracy is reached when the attention was distracted during the first stimulus; and in four cases, the maximum occurs in the series with distraction throughout. How are these results to be explained? Must we conclude that attention is unfavorable to sensible discrimination? The mere figures are of no value in answering this question until they have been interpreted by the introspective evidence gleaned from the subjects during the whole course of the experimentation.

We notice first the evidence bearing upon the nature and effects of the "distraction." The subjects usually found that it acted as a spur rather than as a check to the attention. Their attention was wholly absorbed in the addition for a part of the interval, but as a rule the distraction was not continuous, and there came free instants in which the stimulus flashed into consciousness with great clearness and distinctness. Although the subjects were instructed to give their attention to the addition, the fact that they must give some judgment of the stimuli made them instinctively attentive to the stimulus, whenever there was any break in the continuity of the distraction. The series with distraction required greater effort; and if the subject was not in good physical condition, the mind did not pass quickly enough from addition to stimulus and back again. At such times (as also in the infrequent cases when the addition did furnish a continuous distraction) the subjects were completely at a loss how to judge the two stimuli. They seemed to have no memory of them, sometimes even no knowledge of the fact that the second stimulus had been given. The judgments in such cases were nearly as often wrong as right, with a slight tendency to overestimate the unnoticed stimulus.

The important fact, then, with regard to the distraction which appears from the evidence gathered in our experiments, is the fact that in many cases it is *not* a distraction in the required sense. It prevents attention to a stimulus for any length of time, but it by no means prevents a clear and keen perception of an object for a fraction of the allotted interval,—a perception that is evidently as useful in the formation of a judgment as the undisturbed perception during the whole 3 sec. in the series without distraction.

The subjects occasionally referred to a loss of "memory" occasioned by the distraction. A stimulus would be perceived, instantly judged with reference to the preceding, but the judgment would be sometimes forgotten in the course of further distraction. On the other hand, two of the sub-

jects (*R.* and *M.*) found it easier to remember stimuli or judgments, when some distraction was given, than when they had no distraction at all.

We know of no experiments that investigate the relation between the duration of attention and the accuracy of judgment, nor have we any statistics to offer on this matter. But we took several series of experiments with lights and distances, in which the subject merely gave a glance at the second object exposed. The judgments in these series were even a little more accurate than in those where the subjects were allowed 3 sec. for the second stimulus. And those who made the judgments were ordinarily better satisfied with the brief glance than with the long exposure. In fact, after the first few experiments some of them habitually gave the judgment as soon as they had opened their eyes the second time, —not caring at all for a longer observation. They were not cautioned against this mode of judgment, because the experimenter was more concerned with the "goodness," or degree, of their attention than with its duration. Moreover, the sound experiments gave only a momentary stimulus, and yet the subjects did not find that this fact made it any more difficult to judge between the stimuli. The time during which a stimulus is attended to doubtless has a marked effect, however, on the length of time it can be remembered. Thus, in these same experiments the subjects were more inclined to look the full 3 sec. at the first object which they knew they must recall at the end of 5 or 6 sec., than at the second object which could be ignored as soon as the judgment was once made.

To summarize the points that are of importance in the preceding analysis of the distraction used, we would notice: (1) that the distraction is discontinuous; (2) that for the required judgments the *duration* of the attention is of little significance, especially in the last interval of the experiments: the *degree* of attention affects the judgment more than the duration; and (3) that the so-called distraction shortens the duration of the attention, but, as a rule, on account of its lack of continuity, allows the subject brief intervals of attention; and at the same time, by adding definiteness and interest to the task, it heightens the degree of attention. The subject is alert and active; the distraction works, as we have said, more as a spur than as a check. The inevitable conclusion from these observations is a distrust of *any* inferences drawn from such experiments. Until we have some reliable experimental control of attention, until we can objectively regulate its degree, and know the effects of its duration, and the relative value of the various ways in which individuals seek to reinforce attention,—until we have some answers to

these questions, we can have little confidence in the array of figures supposed to represent attention and inattention. We may quote here a passage from Münsterberg's writings:

"Through empty experiments, which have figures as their chief result, psychology can be helped into a dilemma which is as fatal to it as any metaphysical presupposition. Numbers in and of themselves have no value, only concrete numbers can possess any scientific significance; and there is danger of collecting numbers, of examining and explaining these in their relations, without considering the preliminary question of what these numbers really mean and for what psychological process they furnish a measure. If the usefulness of the experimental method is not to be paralyzed by the injuries brought upon it by the ambiguity of indefinite numbers, every investigation must be preceded by a very thorough consideration of what the desired numbers can and must properly signify. And above all, the subject, from whose psychical experience the numbers are obtained, must clothe the numerical skeleton with the flesh and blood of his own most accurate recollection of the conscious processes experienced."[1]

It seems to us that Prof. Münsterberg's condemnation of "experiments which have figures as their chief results" may apply in some measure to this part of his own work. To further justify this conclusion we shall mention here some of the disturbing factors discovered in the course of our work.

(1) In the series with weights we noticed that some subjects relaxed the muscles of the hand and arm after raising the first weight, while others tried to keep them in just the condition assumed while raising the first weight until the second weight was given. This latter method seemed subjectively much more certain and accurate to those who used it than the method of relaxing the hand in the interval, but it was decided that greater constancy of conditions would be secured by the relaxation method, and from the time that the difference was discovered, the subjects let the hand fall loosely during the intervals between the raising of weights.

"The comparative accuracy of the two methods of judging weights was investigated by Prof. C. E. Parrish, of Randolph-Macon College, who has kindly allowed her results to be given here. Series of experiments, from 150 to 225 in number, were given to seven subjects, no one of whom had any knowledge of the question being investigated. Each subject was given weights to raise, and to judge heavier or lighter, in the manner already described in our own experiments. The standard weights were from 250-270 gms., and the differences given were from 10-30 gms. Every series of experiments was given twice. The first time the subject was told to keep the muscles of the hand and arm in precisely the same state they were in while he was raising the first weight until the second weight was lowered into the hand. When the series was repeated, he was told to relax all the muscles of the arm during the interval before the raising of the second weight. The tabulated results are as follows:

[1] Quoted by Heinrich, "*Die Moderne Psychologie*," p. 154.

Discrimination of Weights with Muscles Adjusted and Relaxed.

Subjects.	Number of Experiments.	Percentages of Correct Judgments.	
		Muscles Adjusted.	Muscles Relaxed.
W.	226	63	89
B.	150	77.3	78.6
K.	112	78	92
D.	158	79	86
Br.	184	70	79
H.	166	71	69
M.	176	83	78

From this table it will be seen that five of the seven subjects reached their best results with the hand relaxed. Of the other two, who were both entirely new to laboratory work, the experimenter states that *M.* did not fully relax the hand, and, when the signal was given to have the hand ready for the second weight, tried to put her hand into the same state of tension that it had with the first weight. So that this series really does not fulfill the conditions of the experiment. The variation of the *H.* series is to be explained in a different way. *H.* visualized the weights very definitely, and speaks of "keeping the image in her mind" throughout the interval between the two weights. She saw "a black ring of weight" where the funnel rested on her hand. She kept this image, and compared it with the "ring of weight" seen when the second funnel rested in her hand. When the visualizing element is so strong, it is not surprising to find results that are quite different. We are far more accustomed to attending to visual ideas than to the sensations of pressure and contraction accompanying any adjustment of the hand. Trained by daily experience, the attention can be directed much more steadily and successfully to a visual image. And so it happens that in the case of *H.*, where the attention is fixed on a visual idea, a particular adjustment of the hand is more easily and accurately kept than when the attention is directed toward the sensations from the hand and wrist. In the latter case a greater degree of accuracy is secured when the hand is relaxed in the interval, just because the attention is so little used to the investigation and control of muscular and pressure sensations that it fails to preserve a particular adjustment of the muscles concerned. The very effort to attend introduces small changes in the muscular contraction and causes slight fatigue or summation effects, with a consequent tendency to overestimate the second weight.

(2) Another individual variation discovered in the course of the experiments was the difference in the methods of adding numbers. Some visualized the numbers, some depended more upon auditory or tactual-verbal images. As a result

the addition was much less of a distraction to some than to others.

(3) There was an equally marked difference in the way in which the first stimulus was remembered. Some retained visual images of the disks and distances throughout any undisturbed interval, or heard again and felt again the sounds and weights just given. Others let the interval remain empty, so far as possible, and recalled the first stimulus only when the second was given. We believe that these differences are intimately connected with the individual differences in the relative frequency of overestimation in the four series. For the memorial images tend to grow fainter, even as this short time passes, unless a pronounced effort is made to prevent their decrease. The effort, however, is more likely to introduce errors than the tendency it seeks to correct, so that the subjects who retained memorial images made no special attempt to prevent the slight diminution of intensity naturally present. In the series of A-A^1 and A-I^1, this factor will have some influence; in the series I-I^1 it could have no part, because none of the subjects retained their images while they were adding numbers. In the series of I-A^1, the addition, as a rule, lasted into the intervening period, so that in this series memorial images occurred less frequently. We cannot give statistics from our own experiments to show the relation between the appearance of memorial images and the overestimation of the second stimulus. But after the individual differences with regard to the occurrence of memorial images had been discovered, occasional notes were taken of the subjects and series in which they were most common. The cases noted are those of *P.* and *W.* in the series A-A^1 with disks, and series A-A^1 and A-I^1 with distances; in series A-A^1 and A-I^1 with weights, images were less definitely and less frequently present. Reference to these instances will show that the retention of the image is accompanied by a tendency to overestimate the second stimulus. In the experiments with weights the tendency is weaker in the series A-A^1 than in the series A-I^1. This anomaly, and the occasional appearance of a strong preponderance of overestimation in subjects and series that were quite free from the memorial images, indicate that other factors must take part in producing the tabulated results, and explanations must not depend too much upon the influence of the images in the series where they were specially noticed. Still, on the other hand, their influence must not be ignored. We shall refer to this somewhat later when we take up Prof. Münsterberg's conclusions.

Some light has been thrown upon the last two topics by the results of a series of experiments performed by Mr. F. E. Moyer

He gave three subjects the task of discriminating shades of gray produced by rotating disks under the general conditions of Prof. Münsterberg's experiments and our own. The important differences were as follows: (1) In series I-A^1 and A-I^1, he gave only about 50 experiments, while in A-A^1 and I-I^1 he gave 90 or 100. (2) He gave about twice as many experiments where the only possible error was a judgment of "darker" as where the error must be a judgment of "lighter." Hence the percentages given in his table are not percentages of the whole number of experiments, but only percentages of correct judgments in the number of experiments belonging to each class. (3) Another variation was the restriction of the smaller differences to be discriminated to one class of experiments,—that which allowed errors only in the direction of judging darker. Mr. Moyer's chief object in these experiments was the study of the different ways in which the subjects added and carried the memory of the first disk through the intervals of free and distracted attention[1]. The three differences in experimental conditions just mentioned were introduced for the sake of his own subject. But his tabular results are also valuable for comparison with my own within certain limits not affected by the variations adopted. For since precisely the same series were given by Mr. Moyer to his three subjects, and repeated in all four sets of conditions, the results of the different subjects and sets can be legitimately compared with each other. We also call attention here, as before, to the fact that "overestimation" is used, *in the table*, to mean an error in judging the second disk to be lighter. We do this in order to avoid confusion in the reading and comparison of the different tables in Prof. Münsterberg's article and our own. But, as we have already said, for reasons given under the next topic, it is more often true that the term *ought* to be applied to errors in the direction of judging a disk to be *darker*. Finally, a new set of figures has been introduced into this table to show the whole number of experiments in each class and the number of errors.

With this table before us, let us turn for a moment to the evidence gathered by Mr. Moyer with regard to the ways in which the three subjects combined addition with the discrimination of the different shades of gray.

(1) *Different modes of addition: their value as distractions.* One subject, *R.*, first visualized the numbers given her, in order to get a good, clear memory of them, and then continued the process of addition by auditory images. This subject repeatedly states that she sees the disks clearly *while* she is adding. Both from her own testimony and from her comparative accuracy in many series "with distraction," it is evident that the addition was often no distraction at all. Another subject, *H.*, visualized the first numbers given, but lost the visual image immediately, and added by means of auditory and tactual-verbal images. The disks were not seen during the whole process of addition, but appeared, clearly and distinctly, at certain stages in the addition. After some practice this subject found it much easier to coördinate the addition and the judgment of the disks than at the first. Here, again, the addition ceased to be a serious distraction. The third subject, *P.*, finds that his attention alternates in the same way between the addition and the judgment. His most noticeable peculiarity is the absence of visual and auditory images during addition. He uses tactual-verbal images

[1] Mr. Moyer's own report of this experimental work will be published in a later number of this JOURNAL.

Subject.		A-A'. Total.	A-A'. Chances for overestimation.	A-A'. Chances for underestimation.	A-A'. Preponderance of overestimation.	I-A'. Total.	I-A'. Chances for overestimation.	I-A'. Chances for underestimation.	I-A'. Preponderance of overestimation.	A-I'. Total.	A-I'. Chances for overestimation.	A-I'. Chances for underestimation.	A-I'. Preponderance of overestimation.	I-I'. Total.	I-I'. Chances for overestimation.	I-I'. Chances for underestimation.	I-I'. Preponderance of overestimation.
R.	No. of experiments,	101	32	69		49	16	33		46	16	36		98	33	65	
	No. of errors,	27	2	25	−30	9	1	8	−18	7	2	5	−4½	15	1	14	−18½
	Percentage correct,	73¼	93¾	63¾		81⅝	93¾	75¾		84⅝	87½	83⅓		84.7	97	78.5	
P.	No. of experiments,	104	26	78		44	10	34		56	16	40		94	25	69	
	No. of errors,	28	5	23	−10.2	12	1	11	−22.4	14	2	12	−17.5	38	8	30	−11.5
	Percentage correct,	73.7	80.7	70.5		72.7	90	67.6		75	87.5	70		59.6	68	56.5	
H.	No. of experiments,	95	33	62		60	19	41		52	16	36		90	33	57	
	No. of errors,	24	10	14	7.4	13	3	10	−9.8	18	3	15	−23	27	4	23	−27.8
	Percentage correct,	74.7	70	77.4		78.3	84.4	75.6		65	81	58		70	87.8	60	

throughout, except that for an instant, in the beginning, the figures are sometimes visualized.

The effect of the difference between *R.*'s method, of continuous combination of the two processes, and the method used by *H.* and *P.*, of alternating attention to the two processes, is to be seen in the tabulated results. *R.*'s lowest percentages of accurate judg-

ments is found in the series with no distraction (A-A^1), and her percentage in the series with distraction throughout (I-I^1) is as high as in any of the series. On the other hand, *P.* is least correct in the series I-I^1, and quite even in the percentages of the other three series. (The minimum accuracy for *H.* is in still another series, A-I^1,—a peculiarity that is explained, we think, in connection with the factor considered in the following paragraphs.) Mr. Moyer's conclusions with regard to the topic of this present paragraph may be summed up as follows: (1) The subjects use distinctly different methods of addition. (2) The difference in method results in a marked difference in the degree of distraction occasioned by the addition.

(2) *The effect of images on overestimation.* Mr. Moyer made a record of about fifty cases in which images were carried through the interval, in order to test the inference drawn from my own experiments,—that the tendency of an image to fade away is likely to favor an overestimation of the second stimulus. Just here it was all important to decide what should be called overestimation and what underestimation. It will be noticed that in Prof. Münsterberg's report the records of two subjects were reconciled with the general theory on the supposition that in two cases the stronger stimuli were the *darker* disks, whereas with two other subjects the stronger stimuli were the *lighter* disks. Now the only basis for such a distinction must be the testimony of the subjects that the lighter or darker disks seemed to them to have a more positive character. Varied evidence (most clear with *H.* and least so with *P.*) indicated that for Mr. Moyer's three subjects the darker disks were the more positive stimuli. Hence "overestimation" *should* refer to a judgment of a disk as too dark, although if we tabulated results merely with reference to the physical stimulus rather than with reference to the psychological perception of it, we should define overestimations and underestimations in precisely the opposite way. But Prof. Münsterberg is certainly justified in giving precedence unhesitatingly to the psychological factor here; and we simply emphasize that method of procedure by applying it to all three subjects, instead of confining it to those whose results can not be explained in any other way.

With the interpretation, then, of "overestimation" as a judgment of a stimulus as *darker* than it was, we turn to the following results: In the series with no distraction (A-A^1): (1) when the second stimulus was lighter, *P.* had 36% more of overestimations than of underestimations, *R.* had 2.38% more of overestimations, *H.* had 13.47% more of overestimations; (2) when the second stimulus was darker, *P.* had 16⅔% less of underestimations than of overestimations, *R.* had no difference, *H.* had 5% more of underestimations (only sixteen experiments).

No data were collected from the other series because images were not noticed in two of them, I-A^1 and I-I^1; while in the third, A-I^1, they were soon interrupted by the giving of the numbers for addition.

The results just quoted for cases in the series A-A^1, in which the memorial image did have an opportunity to exert its full influence, seem at first glance somewhat ambiguous. But the apparent ambiguity has its own significance. We notice that in the first part, when the second stimulus was lighter, *P.* has the largest preponderance of overestimation, *H.* the next largest, while *R.* has only 2.38%. Now *P.* has been proved to be a poor visualizer; *H.* visualizes rather better, but still quite indefinitely; while *R.* is a clear and definite visualizer. Consequently *R.* holds an image well, at-

tending steadily a nd evenly to its various details; while *H.* and *P.* have a more vague and scanty image, and are likely to find it dying away. The second part of the experiments, those in which the second stimulus was darker, shows precisely the same tendencies, with the exception of those made with *H.*; but this exception is worthless, since it is based on only sixteen experiments.

(3) *Comparison of results with Prof. Münsterberg's and our own.* This comparison can be made more intelligibly when we are discussing the bearing of our own results upon Prof. Münsterberg's conclusions. (See p. 58.)

II. *Comparison of our results with Prof. Münsterberg's, with statement of our criticisms and conclusions.*

The first and most fundamental question that arises as one reads Prof. Münsterberg's account of his experiments is a question with regard to the validity of his decision to compare the series A-A^1 only with I-A^1 and the series I-I^1 only with A-I^1. He gives the following reason for thus confining the comparison:

> A-A^1, as well as I-I^1, give the constant error resulting from position, although with a different mean variation. It appears, however, that the results in the two series are different; the overestimating of the second stimulus in the case of A-A^1 being much more marked than in the case of I-I^1. Accordingly, we should compare those series only in which the judgment is made under the same conditions. That is, A-A^1 ought to be compared only with I-A^1, and in the same way I-I^1 only with A-I^1. . . . . Obviously, the actual numbers are valid merely for the relations of these stimuli chosen arbitrarily, and only their relative value, considered as plus or minus, comes in question.[1]

Looking at the results of our own experiments, the first statement which fails to apply to our results is that "the overestimating of the second stimulus is much more marked in the case of A-A^1 than I-I^1." We found several cases in which this was true, but there were also several cases in which it was not at all true. Two subjects in the series with weights, two in the series with disks, two in the series with sounds, and one in the series with distances, overestimate the second stimulus more frequently in the series I-I^1 than in the series A-A^1, while two more show a preponderance in the other direction of only 1 and 2%. So that nine out of the fifteen cases fail to confirm Prof. Münsterberg's comparison.

It might still be maintained, however, that although there is no constant difference, in one direction or the other, between A-A^1 and I-I^1, the reason given (independently of the relative overestimation) for limiting the comparison holds good, viz., that "we should compare those series only in which the judgment is made under the same conditions." This would be a sufficient reason if the conditions under which the judgment

[1] *Op. cit.*, p. 40.

is *finally* made were the only conditions affecting the overestimation or underestimation of the second stimulus. But, in the first place, we have already referred to one factor (*i. e.*, the presence of memorial images) that in certain subjects exercises considerable influence in the series A-A^1 and A-I^1. And, in the second place, we maintain that the judgment must be affected quite as much by any circumstance that exerts an influence on the memory of the first stimulus as by the conditions existing at the moment a judgment is made. Since it is quite as probable that the memory of the first interval is affected by the way in which the intervening period is passed as that the final judgment is affected by the conditions under which the second stimulus is received, we maintain that *all four* series must be compared in order to make due allowance for both sorts of influence. Indeed, if either one is to be ignored, we think it should be just the one that Prof. Münsterberg has considered all important. For what *is* this "difference in the conditions under which the judgment is made" except the very matter under investigation, *i. e.*, the difference between free and distracted attention? And it seems strange that on this basis two series should be cut off from comparison with the very two that exhibit the other phase of the problem in question.

If, however, setting aside Prof. Münsterberg's restriction, we do compare all four series, then, in order to sustain his conclusion that "all stimuli appear relatively less when the attention is from the outset directed to them," the series A-I^1 should show a relatively greater, and the series I-A^1 a relatively smaller, preponderance of overestimation of the second stimulus than A-A^1 or I-I^1. Examining Prof. Münsterberg's results, we find this to be true in only three cases out of ten. In our own results it holds good in only five cases out of fifteen. We take this as further evidence that these series are not what they profess to be; they are not pure experiments with free and distracted attention.

On the other hand, even if we should accept the restriction to which we object, and follow Prof. Münsterberg's example in comparing series A-A^1 only with I-A^1, and I I^1 only with A-I^1, our results still fail to harmonize with his. In thirty comparisons sixteen agree and fourteen disagree with his statement. So that whether we accept or reject the restriction, we are wholly unable to accept the conclusion that stimuli appear relatively less when attended to.

Reference to the tabulated results of Mr. Moyer's experiments given on page 55 will show that his results work against Prof. Münsterberg's conclusions in the same way that my own do. As they were performed wholly independently and for the investiga-

tion of a different problem, the concurrence of the two results is worthy of consideration. Mr. Moyer's experiments, like my own, fail to confirm the conclusion that attention lessens the intensity of a stimulus. If we compare his series in accordance with Prof. Münsterberg's directions, we find that out of six comparisons three agree and three disagree with Prof. Münsterberg's conclusion.

Our second criticism of Prof. Münsterberg's experimental work is a criticism of the way in which he has handled his numerical results. Every error in judgment is given the same numerical value, whether the stimuli wrongly judged were equal, nearly equal, or widely different. Such an evaluation of results is quite as capable of concealing a tendency as of revealing it. We have of necessity followed the same method since our first object was a comparison of results. At the same time we think it must be condemned as untrustworthy and unscientific. Only the discovery of sources of error which convince us of the worthlessness of the experiments in connection with their original problem, allows us to leave them without recasting the results on a more scientific basis of evaluation.

In the third place, if we turn to Prof. Münsterberg's *explanation* of the conclusions drawn from the experiments, we find an explanation that will not apply to attention in general or to the kind of attention used in our own work. The explanation is valid only where there is a pre-adjustment of the attention to some particular stimulus.

To draw out our meaning further, we quote a few sentences from the last paragraph of the article:

"The explanation seems to me to rest in the fact that we must always judge intensities relatively, the standard being in our muscular tensions. . . . . Let these be previously strengthened by expectant attention and the stimulus will appear weaker than if the stimulus itself were to arouse reflexly all the corresponding muscular tensions. . . . The feeling of intensity comes to represent the intensity of a stimulus only through its relation to the subjective sense of strain. If we purposely strengthen the subjective strain simultaneously with the strains aroused by the stimulus, the stimulus will indeed appear stronger, because we interpret the tension as the result of the stimulus. . . . If, on the other hand, the tension precede the stimulus as an element in the preparatory adjustment of the attention, and if consequently it be interpreted by consciousness, from the outset, as a subjective function, the increase of the tension aroused by the stimulus can appear only slight, the ratio of the two intensities has become reversed, and accordingly the stimulus is slightly underestimated."

All this may be quite true. Such a possibility of weakening an impression by a certain preparatory adjustment of the attention was noticed by G. E. Müller nearly twenty years ago, and it has been verified many times. But it is only true of attention when it is working under peculiar conditions and

in one particular way. Prof. Stanley has emphasized this point in his discussion of Prof. Münsterberg's article. After some reference to the genetic development of attention, he says:

"Believing, then, that sensation intensities are bound up with attention intensities as a general fact of mind, we were interested to see how Dr. Münsterberg's experiments would bear on this law, to which he alludes in his opening remarks as the scope of his inquiry. However, we discover that it is only a certain kind of attention, expectant, and a certain kind of this, too much expectancy, that is really treated, with the result that sensations of light, sound, etc., are rendered less intense when we set our attention at too high a notch."[1]

In our own experiments there was no preparatory adjustment of the attention to a definite intensity of stimulus,—no "expectant" attention to any specific memory image. Attention in our case meant, to use Exner's terms, an inhibition of stimuli in general, and a readiness for, or a "facilitation" of, a certain class of stimuli. It cleared the field of all other impressions and said, "Something is coming *this* way. Ready, look!"

In the passage just quoted Prof. Münsterberg maintains that the subjective strain due to a preparatory adjustment of attention is distinguished in consciousness from the strain aroused by the stimulus, but if the subjective strain is strengthened simultaneously with the strain aroused by the stimulus, the two are not distinguished; "we interpret the tension as the result of the stimulus." This brings forward once more the question discussed in the preceding chapter—the question of the distinction between increase of intensity due to attention and to changes in the stimulus (pp. 37-38, 40-41). We think that the view there cited from Exner is the only one that is consistent with the facts of experience. For instance, when we are listening to the far-away striking of a clock, we do not confuse the subjective tension with the tension aroused by the stimulus. Although the distinction of the two is more difficult when they occur simultaneously, it cannot be impossible; for the same data are given in consciousness when their occurrence is simultaneous as when successive, only they are more obscure in the former case than in the latter. The quick notice and accurate memory of an expert, however, will render possible the analysis of either complex state. Indeed, unless there were certain *measures* of the facilitation due to attention by which it could be distinguished from the intensity of the stimulus, attention would obscure and interfere with every case of sensible discrimina-

[1] "Attention as Intensifying Sensation," H. M. Stanley, *Psych. Rev.*, II, p. 55.

tion,—and we believe that no one holds this to be true. On the other hand, we do not wish to dispute Prof. Münsterberg's statement that expectation of too great or too small a stimulus causes underestimation or overestimation of the stimulus actually present. But we affirm that such expectation is not an essential element in attention. We are more and more convinced that there is no necessity that attention should produce either result; and we hope to show in the next section that both effects may more properly be traced to certain sources of error and of individual variation noticed in the course of our experiments.

III. *Discussion of the sources of error observed and the precautions suggested.* The mention of the sources of confusion discovered in our own experiments may be the best conclusion of our present account. Our other results have been largely critical and negative. We may hope that their worth is not decreased on this account, since the whole subject of attention is still in so chaotic a state. Negative criticism of conclusions too hastily reached is specially needed in the first stage of experimentation in any subject,—and experiments upon attention, with the exception of those upon oscillations of the attention, have hardly passed beyond the first stage. Moreover, if negative criticism can indicate clearly enough the sources of error in the works which it criticises, it leads in the end to a knowledge of how the errors are to be avoided, and shows, in part, at least, the correct method for the solution of the problem.

We conclude, from our own experiments, that the most probable sources of error are as follows: (1) *The pre-adjustment of the attention.* There should be objective aids to secure, so far as possible, constancy in the manner and degree of the adjustment. Any means for securing similarity of conditions at the outset will do much toward ensuring trustworthy results. We have said that in our own experiments there was no definite pre-adjustment,—no preparatory recall of a particular stimulus. Prof. Münsterberg's closing paragraphs indicate that he did have such preparatory adjustments in his experiments. To avoid these differences and to prevent the appearance of other disturbing factors in the first stage of the experiment, it would be well to start with the same stimulus in all the experiments. Let the subject know that the first stimulus is always the same, and let him keep account of its apparent variations, if there are any. Such a partial use of the "method with knowledge" would be of value in giving the attention a definite direction. It would help to insure the same degree as well as the same kind of attention or of preparatory adjustment. This single

precaution would go far, we believe, toward correcting or eliminating the fluctuations, contrast effects, variations in adjustment, etc., that are otherwise likely to occur during the exposure of the first stimulus and during the interval between the two stimuli.

(2) The experimenter must use some measure, however crude, of the *continuity of the distraction*. For this purpose he must take notice (a) of the regularity or irregularity of the rate at which the subject works; (b) of the most effective kinds of distraction, and (c) of the ways in which the subject treats whatever is assigned for a distraction. Under these three topics we have a few suggestions to offer as the fruit of our experimental work.

(a) It might be advisable to arrange the distraction and the apparatus so that the rate at which the subject does whatever is given him to do, may be recorded. This time record would reveal clearly—and often at the moment, and to the subject himself—the irregularity and discontinuity of his attention to the objects discriminated or to the distracting stimulus. This information would *tend* to make him more even and uninterrupted in his attention to one or the other. The record would also tell the experimenter something of the degree and value of the distraction. Yet too much must not be expected from this device. (b) Our experiments, and others conducted in the same laboratory, indicate that in spite of every effort exerted to keep the distraction continuous, any task of so intellectual a nature as addition will permit intervals of keen attention to other objects. It was noticed, however, that when the addition was performed while there was any strong affective coloring of the subject's consciousness, it was usually a successful means of distraction. Affective reactions rarely, and only accidentally, accompany the addition of numbers, the recognition of liminal stimuli, the perception of regular intervals of time by metronome beats, and the other similar distractions which have been used in the experimental study of attention. But it is possible that other stimuli may have a much stronger affective tone. This is in general true of all strong odors.[1] And besides these, each individual has certain classes of perceptions which are very likely to arouse strong feeling. Singing aloud, reciting with careful expression one's favorite poems, reading or writing backward, recalling details of a beautiful landscape or painting,—these and many other such tasks will affect different individuals very differently, and for certain subjects we have found them to be quite a satis-

[1] This fact was evident in the experiments by Mr. Moyer already referred to, p. 54.

factory distraction. (c) Whatever distraction may be used, it is evident that the experimenter *must* know, as well as he can, *how* the different subjects are treating the task assigned for distraction. It is as important to know this as to know the way in which the subjects attend to the stimuli to be discriminated. It would seem to us quite unnecessary to emphasize directions so apparent as these if they had not been unpardonably ignored in the experimental study of attention. As we have already said, Mr. Moyer's investigation of addition as a means of distraction, showed that it was treated differently by each of the three subjects. One was visual and auditory-verbal; one was auditory-verbal and tactual-verbal; the third was quite purely tactual-verbal in his method of adding. And these differences affected the results. The experimenter cannot give any reliable interpretation whatever of his results without an analysis of these complicating factors. Control of the variations in the treatment of the distraction may be impossible, but this fact will not destroy the value of the experiments if only the variations are known and if their influence is carefully traced.

(3) The subject's *methods of remembering* a stimulus must be noticed in the same way that his ways of attending or of pre-adjusting the attention are to be observed. The most important instance under this head that we can give from our own experiments is the instance of the presence and absence of memorial (reproductive) images in different series. We have only to refer again to the account given of Mr. Moyer's experiments to show the influence of the memorial image upon the overestimation of the second stimulus. Besides the persistence of definite images, other mnemonic aids may be used and may affect the results. Certain subjects, who do not steadily retain any images, recall them at stated intervals, usually with each inspiration or expiration of the breath. Under these circumstances the coincidence of the second stimulus with the moment for the recall of the image will make considerable difference in the accuracy and the direction of the results. Any other aids to memory—naming, localizing, etc.—may be used by the subjects; and here again it is necessary for the experimenter to know what factors are entering into the experiments.

(4) Results obtained by one method, *e. g.*, attention in sensible discrimination, must be *tested by experiments in other methods*, *e. g.*, reaction to a stimulus. This latter method has been well developed by Patrizi.[1] By means of an

[1] "*La Graphique Psychométrique de l'Attention*," *Archives Italiennes de Biologie*, Vol. XXII, pp. 189-196.

electrically driven Baltzar kymograph and an electric circuit, including a Deprèz signal and an electro-magnetic hammer, he secured a record of sixty successive reactions made within an interval of two minutes. The stimulus recurred regularly at intervals of two seconds. The subject reacted to the stimulus as soon as possible, and the record of stimulus and reaction left on the rotating cylinder showed how much time had intervened between the two. The hammer could be replaced by a Geissler tube or a simple shock apparatus when it was desirable to use other kinds of stimulation. By means of this apparatus, Patrizi obtained a graphic record of the degree or goodness of the attention, since (other things equal) it is evidently inversely proportional to the time of the reaction. The method has also the merit of investigating attention under purer conditions than are found in other methods, because the quick recurrence of the stimulus helps very much to prevent the wandering and "unpreparedness" of the attention. And the fact that "the stimuli given are always well above the limen of any sense department, eliminates the effects of the adjustment and muscular fatigue of the peripheral sense organs that have complicated all the experiments on oscillations of attention." Experiments performed by Patrizi's method could be advantageously compared with those by another method in two ways: (1) It can be used to find the comparative value of different distractions; and (2) after the value of the distraction is known, the relations of different degrees of attention and inattention shown in the numerical results of one method can be verified or modified by the graphic results of this other method.

In closing we wish to give brief notice of "An Investigation of the Distraction of Attention" made by Bertels.[1] It is the only thesis on the subject that we have yet come across, and deserves consideration on that account. But the author's work does not touch the problems with which we have been dealing. Bertels started with three questions in mind. "1. How is distraction affected by the intensity of the distracting stimulus? 2. How is it affected by the interval between the test-stimulus and the distracting stimulus? 3. How is it affected by the quality of the distracting and the test-stimuli?"[2] But he had time to investigate only the second question—the effect of the interval between the two

[1] "*Versuche über die Ablenkung der Aufmerksamkeit.*" Dorpat, 1889. A. Bertels.

[2] *Op. cit.*, p. 10.

stimuli. Visual stimuli were used in all the experiments. The distracting stimulus, as well as the test-stimulus, was given only for a moment. Light was admitted for an instant into a tube leading to one eye, and then after an interval, light was admitted to another tube containing two Nicol prisms. The distracting effect of the first stimulus was measured by the angle through which one of the Nicols had to be turned before the second light could be discerned. The most important result of his experiments was the discovery that the first stimulus acted more as a signal-stimulus than as a means of distraction. It distinctly aided the attention, most of all at an interval of $2\frac{3}{5}$ seconds, and at intervals that were multiples of this number. So that the thesis tells us nothing with regard to distraction, except that what was expected to act as a distraction acted otherwise.

Summary of the four chapters.

The introductory chapter briefly discussed certain physiological concepts, which play an important part in theories of attention; *i. e.*, the question of the nature and extent of cerebral localization, and the question of neural reinforcement or facilitation (*Bahnung*), and neural inhibition (*Hemmung*).

The second chapter analyzed the "descriptive" theories of attention, or those which deal chiefly with the effects and secondary phenomena of attention. These theories describe attention as merely motor (Ribot and Münsterberg), merely sensory (Bastian, Marillier, etc.), or as sensori-motor (Waller). The discussion of these three classes involved reference to the controversy over sensory and motor centres in the cortex, the correlation of consciousness with efferent nerve currents, and allied topics.

In the third chapter the "explanatory" theories of attention were presented—those which seek for the fundamental principles in the process. The three types found here regard attention as a facilitation (G. E. Müller), as an inhibition (Wundt and Külpe), or as a combined facilitation and inhibition of stimuli (Exner). After a review of each theory separately, we discussed the fundamental differences between them, and especially the problems still left unsettled by one or all of these theories. Some of the most important topics were the relation between attention and the increased clearness of an idea, the "feeling of activity," inhibition, associative co-excitation, reinforcement or facilitation, changes in intensity due to attention and due to variations in the stimulus.

The fourth and last chapter, under the title, "Attention and Distraction," gives an account of an experimental investigation of the effect of so-called distractions on sensible discrimination. The experiments are, in part, a repetition of those made by Prof. Münsterberg in his study of "Attention as Intensifying Sensation." The negative and critical results of our work show that the experiments do not sustain Prof. Münsterberg's conclusion, "that all stimuli appear relatively less when attention is directed to them from the outset." (1) The distraction acted more often as an incentive or spur than as a check to the attention, and this fact renders the experiments worthless for their original purpose; (2) Disturbing factors were noticed which materially affected the numerical results. These factors were not considered, and no precautions were taken against them in the original experiments. Among the most important we would mention the effects of the presence or absence of distinct memory images, different ways of treating the distraction, and different methods of judging weights. (3) The original experiments treat only a certain kind of attention, expectant, and a certain degree of this, too much expectancy; their results, even if they were wholly accurate, could not apply to attention under any other conditions. (4) An unscientific treatment of the numerical results destroys the force of any psychological conclusions based upon them. The positive results of our work have taken the form of certain directions advisable for further experimentation. They refer: (1) to a pre-adjustment of the attention; (2) to the continuity of the distraction; (3) to methods for remembering stimuli; (4) to the testing of results obtained from one method by those secured from other methods. The chapter closes with brief mention of an earlier study of distraction by Bertels.

OLD AGE AND DEATH.

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Biological. From the most general point of view it must be admitted that senescence is a constant accompaniment of development. The evolution of both the race and the individual is as much concerned with the effective dismissal of old and ante-dated organs as with the production of new ones.[1] Minot[2] indeed regards the whole course of individual life from the moment of the union of the two reproductive cells as a gradual decay, and has attempted by elaborate weighings to prove that during the minority or period of growth of guinea pigs, the actual vital force diminishes steadily. At the same time we must not lose sight of the fact that senescing cells, such as glandular products and organs like the gill-slits, etc., of the vertebrata, exercise a stimulating influence upon the organs which remain or take their place. Their force is passed on rather than lost, and while decay is undoubtedly a constant and necessary factor in all vital manifestations, and whatever may be true of the ultimate "vital force," it must be admitted that the functions of life as they may be observed in any specialized organism, increase for a time in strength, range, and complexity, pass through a period of comparative poise, and finally break up and disappear. These three natural periods, however further they may be divided (Cf. Flourens, *e. g.*) are emphatically punctuated by the advent and decline of the sexual and reproductive functions, which may thus be regarded as crowning the physiological development of the individual.

In many species, however, as Weissmann, Goette, Geddes and others have pointed out, the closing stage is wanting. There is no gradual senescence, but death

[1] The ability to forget, *e. g.*, is as important to psychic health as the capacity to acquire. Cf. paragraph on the funeral.

[2] *Jour. Phys.*, May, '91, and *Biologisches Centralblatt*, XV, No. 15.

follows immediately upon the completion of the reproductive functions. Weissmann regards this as due entirely to external conditions operating upon the individual through natural selection, and tries to show that death is a favorable adaptation to get rid of senility, which he thus accepts as fundamental and due to a "wearing out." Goette[1] on the other hand regards death as the fundamental fact, a necessity inherent in life itself, an unavoidable consequence of reproduction, and represented in the protozoa by encystment and rejuvenation.[2] Death must, he says, have become necessary and hereditary in a number of individuals before it could possibly become useful and thus operated upon by natural selection.[3] Senility he regards as having been "acquired in the course of development of the race."[4]

But it is impossible to separate, as Weissmann does completely and Goette to a less extent, the individual and its environment. A view which combines the internal physiological causes of Goette and the external, natural selection, or teleological causes of Weissmann as both necessary and complementary to each other, is the only one which can have any application to organisms as they at present exist. The point of fundamental importance brought out by both Goette and Weissmann is that death and senility are ultimately functions of the species, primarily of phylogenetic importance, whether regarded as being originally necessary to the continuance of life, or impressed upon it from without, and enter the life of the individual as such, in connection with the sexual and reproductive functions.

The experiments of Maupas[5] with *Stylonichia pustulata*, one of the most highly developed protozoans, are interpreted by him (in opposition to Weissmann's view of the immortality of the protozoans) as demonstrating the fact of senile degeneration followed by death in these animals. *S. pustulata* multiplies by division at a temperature of 24° to 28° C., dividing as often as five times in twenty-four hours.[6] Beginning with an individual which had just conjugated, Maupas followed the multiplication to the 313th division when he had 510 individuals. He

[1] Life and Death, "Biological Memoirs," p. 135.
[2] "*Ueber der Ursprung des Todes.*"
[3] *Op. cit.*, p. 6.
[4] *Op. cit.*, p. 54.
[5] *Recherches expérimentales sur la multiplication des infusories ciliés*, in the *Archives de Zoölogie expér. et gen.*, 1888, No. 2.
[6] If all of the resulting individuals could be nourished to the fiftieth generation, that is, in thirty days, there would be one followed by forty-four zeros, which, if united in one mass, would make a sphere a million times greater than the sun in volume.

found that at the 100th division degeneration began and increased to the 240th. At the 130th generation, sexed individuals appeared, which were about half the original volume. At the last fission the animals were only 1-60 of the original volume. At the 316th division he isolated one of the 510 individuals and found that it produced "nothing but abortions, incapable of reproducing, and which shortly died."[1] This extinction Maupas calls senile degeneration, thus very questionably homologizing this series of separate cells, artificially prevented from normal conjugation, with a series of mutually dependent and connected cells such as may be found in any metazoan. A. M. Marshall[2] appears to accept this homology, but nevertheless agrees with Weissmann in thinking that death is not an intrinsic necessity of life, but appears first in the higher protozoan in close reciprocal connection with conjugation and reproduction. Since we do not know, says he,[3] "at what period or to what extent the somatic cells of a metazoan lose their power of conjugating," nor what occurs in vaccination or transfusion of blood, he suggests, as a matter of theory, the possibility of discovering some means of rejuvenescence for the somatic cells, a possibility which G. A. Stephens of Norway Lake, Me. ("Long Life"), in establishing a laboratory for the purpose, seems to be inclined to devote some effort towards realizing!

Other special hypotheses on the causes of death have not been particularly fruitful. Bütschli[4] thinks that life is the result of a ferment which the protozoans and the germinative plasma have the power of manufacturing. When the ferment is exhausted, life ceases. According to Lendl[5] every cell by the very fact of living accumulates in it substances, some useful, some not, which are nevertheless foreign to the pure germinative plasma. This material he calls *ballast*, and regards it as the cause of death. The reproductive cells keep themselves pure by loading this material on to other cells. He supposes that the protozoans divide so that one cell retains the ballast, while the other is free. A certain number of the protozoans are thus doomed to death. Delbœuf[6] says that the precipitation of the substance of the organs towards the inorganic causes death. Dantec[7] represents death with

[1] J. Delbœuf, "*Pourquoi mourons-nous?*" *Rev. Phil.*, Mar. and Apr., 1891.

[2] "Biological Lectures and Addresses," chap. on Death, p. 283.

[3] P. 287.

[4] "*Gedanken über Leben und Tod*," *Zoöl. Anz.*, V, 64-67.

[5] "*Hypothese über die Entstehung von Soma- und Propagationszellen.*" Jena, 1890.

[6] *Art. cit.*

[7] *Rev. Phil.*, Jan., Feb. and May, 1895.

the primitive forms as an alternative to evolution, or change into another species. This becomes necessary, both because material for assimilation becomes exhausted owing to the narrow confines of the globe, and formed products are left within the plastid. He thinks that it might be much more possible to develop a new species from a moner than to begin higher up the scale where the plastids or individual cells are already highly developed. Delage,[1] observing the almost universal correlation of differentiation with loss of germinative power, looks upon differentiation as the cause of death. Minot[2] insists upon the converse of this and regards the embryo as a special arrangement permitting the increase of undifferentiated cells, and consequently a higher organization. Spencer says that for both somatic and germinal cells it is a matter of environment which may permit or not the continuance of nutrition.

Of the general vital theories, all of which bear upon the question of death and senility, we shall be forced to confine ourselves to a brief mention of the ideas of Roux, which perhaps, because he has paid the greatest attention to ontogeny, apply more directly to the concrete facts, about to be discussed, of the last stage of human existence, where, with the ceasing of the deeply hereditary racial or reproductive life, the more purely individual or ontogenetic features are more sharply defined. Roux[3] is described by Delage in contrast with the animists, evolutionists, and micromerists as an organicist, by which he means the acceptance of a moderate determination by heredity with the addition of "surrounding forces, always active, always necessary, not simply the condition of activity, but an essential element of the final product."[4] Roux thus harmonizes the extremes of Weissmann and Goette, already referred to, by bringing to view the fact of an internal or physiological struggle for existence among the organs, the cells, and the protoplasmic molecules of the organism. "This unsimilarity of parts," says he,[5] "makes it impossible to establish laws of heredity which shall govern details of function to the last cell or molecule,—as in any army the commander-in-chief does not give special orders beforehand affecting every private in the ranks. There must be a possibility of adaptation to surroundings, especially in details, which, too, are more

[1] *Op. cit.*, p. 709.
[2] *Biol. Centr.*, XV, 15.
[3] "*Der Kampf der Theile im Organismus*," Leipsic, 1881.
[4] *Op. cit.*, p. 720.
[5] "*Der Kampf der Theile im Organismus*," p. 71.

easily changed than events on a larger scale." How is this freedom of organs and of adaptation obtained?

Roux believes that the principle that lies back of all development of tissues and organs is over-compensation of what is used, a quality which permits self-regulation, and is really a necessary precondition of life. Living matter, unlike inorganic matter, presents an external continuity in spite of the change of conditions. To effect this, assimilation must always be in excess (over-compensation), for if less than consumption the organism comes to an end of itself. If equal, conditions change, and nourishment will fail or injurious events will cause destruction. Continuance can only be assured when more is assimilated than is consumed. He illustrates this by the example of fire, which assimilates more than it uses, *i. e.*, it always has energy left over to kindle new material. This would (like life) become eternal if it did not use up materials quicker than other processes can make them. In the same way organisms assimilate more than they consume, but they do not turn all they use to assimilation; energy remains over by which the process performs something. This work-product controls the excessive assimilation which otherwise would come to an end by not having sufficient material to assimilate. He thus regards the more complex processes of life as essentially a radiation of assimilation, which, although not identical with combustion, is similar to it, the load which it carries favoring its continuity. This radiation, load, or work-product becomes directed, of course, by natural selection, to keep up a supply of food, primarily by moving the assimilating mass. Performance of function over and above assimilation is just as much a condition of continuous assimilation as assimilation itself is of performance. On the other hand there comes to be an inverse relationship between growth and production (within limits), and we have capacities which, although they use up material, do not in themselves increase assimilation. The course of development consists in properly directing this work-product.[1]

[1] The proper growth of the higher centres favors permanence. Idiots age much earlier and die younger than normal people. Too rapid growth seems connected with this. Geoffroy St. Hilaire (*Hist. des Nom.*, 17th ed., Vol. I, p 197) has given full particulars of a boy of six who was five feet high and broad in proportion. His growth was so rapid that it could almost be seen. He had a beard, looked like a man of thirty, and had every indication of perfect puberty. He had a full, deep bass voice, and his extraordinary strength fitted him for all country work. At five he could carry any distance three measures of rye weighing 84 lbs., and at six years and a few months he could easily carry on his shoulders bur-

This so far represents merely a continuous productability of function in connection with assimilation. But a productability which is stored up and discharged by an outer stimulus of environment will be much more economical, and will give rise to what we find as reflex excitability. When this reflex work-product dominates, according to circumstances, function will sometimes be greater and sometimes less. If under these conditions assimilation keeps on continuously, there must sometimes be an overplus, sometimes a balance, and sometimes by excessive function death, and thus elimination. To avoid this last, it is necessary that assimilation should depend upon use or upon a stimulus which use calls forth. From the psychical side this stimulus is recognized as hunger.

This kind of process where stimulus is an indispensable factor, is more special and limited than the more general process of assimilation plus movement, etc., but has characteristics which favor it greatly in the struggle for existence. "Connected with the most complete self-regulation of functioning is the greatest saving of material, while those parts always according to their use are strengthened and grow, the unused degenerate and the material for their subsistence is saved. This kind of process unites the greatest economy with the highest functioning of the whole, but at the cost of the independence of the parts."[1] Senescence becomes thus a result of differentiation, in which the parts exist merely on account of the function which they perform for the whole. The senescing organs wither up like state officials after pensioning, although they may linger on as pensioners for a long time, and may even descend in this condition from generation to generation, a fact which often allows of fresh starts in development. During the course of a life-time the organism moves from a more general, more easily impressible condition to one which is more perfectly mechanized. "Through a long period it becomes, through the continuous working of a given stimulus, more completely adapted to itself, and also more differentiated, and thereby more stable, so that an always increasing opposition is formed to the additional development of new forms and characteristics."[2]

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dens weighing 150 lbs. But he did not become a giant, as every one expected. He soon got feeble, deformed, his intellectual faculties did not develop. He became idiotic and soon died. Bébé, the court fool of King Stanislas, had all the attributes of decrepitude at 23 years.

[1] "*Der Kampf der Theile im Organismus*," p. 224.

[2] *Op. cit.*, p. 201.

Dantec,[1] while opposing himself to Roux in many points, really offers a simpler form of Roux's conception of over-compensation of used material. According to him function and assimilation are not to be separated at all. He evidently rejects the ordinary analogy of a machine capable of wearing out or running down (fatigue), and regards the activity of every cell or plastid as a chemical combination in which the substances which increase the growth of the plastid are added to the living matter. During the same reaction, however, there may be by-products formed, which, until their removal from the neighborhood, stand in the way of future reaction (fatigue, senility, etc.). Dantec also simplifies the question of death by emphasizing the fact that what dies is always the cell or plastid, or a number of them. The death of a many-celled individual is nothing additional or independent of this.

Longevity and Natural Selection. Whether senility or death is ultimately the most deeply-rooted in the vital process, there seems to be no doubt that in the case of man as compared with the animals most closely related to him, the last of the old age period at least, has come in as a survival, which is correlated with, if it does not owe its existence in the struggle for existence to the greater development of the higher moral and sympathetic qualities of the race.[2] Other reasons, however, have prepared the way, or assisted in this result. Among many of the lower animals a long life is frequently a necessity for the species, when it is associated with decreased fertility or lack of ability to raise offspring. Eagles, for example, live to about 60, but owing to the dangers to which the eggs and young are exposed from weasels, mice, etc.,[3] it takes about this time to successfully raise a pair. Many plants and animals, on the other hand, make up for their short lives by great fertility. This distinction, it is evident, is only of value when comparing species, and is of very little significance for the individual. With some animals, as with man, where the period for raising the young is long, it is found that life is normally increased to this extent beyond the actual sexual period.[4]

But beyond the immediate value for the offspring, in man at least there is an added value in old age for the tribe and

[1] *Rev. Phil.*, Feb., Mar., 1896.
[2] *Cf.* G. M. Humphrey, M. D., "Old Age," 1889, p. 8.
[3] Weissmann, "The Duration of Life," p. 13.
[4] With man the period of growth is variously put, and is actually different in different peoples and classes, the higher classes of the highest races not ceasing to grow physically till about 30. If the grand climacteric be placed at 50 (often earlier), this would give 80 years as the normal life-time, the latter 30 years of which is held in fee for the support and education of the young.

race. Dr. Gascom[1] points out that personal, family and national prosperity and affluence are increased by longevity, and thinks that "longevity, peace and liberty would bless all the world with abundance."[2] In early races old men were the convenient and portable libraries, offering a means of ready reference to past experience. If they were not actually the leaders in times of strain and stress, they were very generally the counselors, the prophets, and the seers.

But while the practical results of old age have probably been favorable, this cannot be expected to have been foreseen or calculated upon. Unreasoning sympathy, an extension of the love for wife and child, has been the deepest motive power. This even becomes intellectualized abnormally in a kind of fetichism, instead of resulting in a calculation on the greatest good for the greatest number, which, despite the possibility of exceptions of individuals like Bentham and J. S. Mill, has never yet become a motive for masses of men. With certain tribes of South Australia, for example, it is *taboo* to catch or eat certain animals until they (the Australians) reach an advanced age. They are convinced that the most evil consequences would result to themselves individually if this rule should be broken. These animals, it is observed, are just those which are the easiest to catch, are perfectly wholesome and nutritious, and thus the best adapted for old people's use. A large proportion of the motives which govern our treatment of the old to-day are really only more refined, although sometimes equally superstitious, and perhaps equally beneficial fetichisms.

From the point of view of natural selection to the question whether old age is to be regarded as an abnormal phenomenon on account of the small number of people who attain it, as Montaigne suggested,[3] or whether the most of men should naturally reach a much greater age,[4] that men do not die, but kill themselves, it might be replied that the present condition where only a few reach an elderly age may be the most serviceable for the race in its present state. As G. M. Beard points out,[5] the majority of people in all lands are muscle-workers rather than brain-workers, and quotes Dr. Mitchell as having shown that if of the population of Scotland a few thousands were destroyed or degenerated and their places unsupplied, the nation would fall downwards to

[1] Prize essay on "Longevity" written for Assurance Co., Boston, 1869.
[2] P. 6.
[3] Essay on "Age."
[4] 100-150, as Flourens held possible.
[5] "American Nervousness," 1881, p. 97.

barbarism. But if these do exist, a superfluity may be unnecessary. Leaders, prophets, seers, are in the way if in too great a number, and it may be better for men to "kill themselves" in effective service, even if not of the rarest kind, than to go on to an old age full of nothing but selfishness, weakness and discontent.

On the other hand, the results of Humphrey,[1] which show that old age is correlated with large families, lead us to expect a gradual increase in old age and just among those stocks which have been successful in serving the basal altruistic functions of the race. The more radiated altruisms also seem favored in the struggle for longevity. Dr. G. M. Beard,[2] believes he has established from statistics that brain-working classes live longer than muscle-working classes, and "that the greatest and hardest brain-workers of history have lived longer on the average than brain-workers of ordinary ability and industry." Donaldson[3] shows from the present admittedly meagre statistics that the curve of brain weight rises with eminent men to 65 years, while it falls from 55 in other classes. Clergymen are particularly long-lived, while born criminals and idiots age quickly and die young.[4] Neurasthenics,[5] generally of an overdeveloped type, are long-lived, although not prolific, as if they represented the last effort of goodstock.

When these distinctions depend upon choice of professions, it has been usual to assume that the character of the occupation exercises the determining influence, although it may just as reasonably be held that the naturally long-lived, sometimes by a sort of instinct, as Dr. Gascom[6] thinks, choose professions where rewards are not obtained till late in life. Farr[7] shows that the greatest commercial value of a laborer is at 25, that of a professional man about 40. As Beard says:[8] "With muscle-workers there is but little accumulation and only a limited increase of reward; and in old age, after their strength has begun to decline, they must, with increasing expense, work even harder than before. . . . . The literary or scientific worker goes on from strength to strength, until what was at 25 impossible, and at 30 difficult, at 35 becomes easy and at 40 a pastime." The oppor-

[1] *Op. cit.*, p. 40.
[2] "American Nervousness," chap. on Old Age, p. 195.
[3] "Growth of the Brain," p. 324.
[4] Lombroso "*L'homme criminel.*" Strahan, "Suicide and Insanity," p. 112.
[5] Beard, Krafft-Ebing *et al.*
[6] *Op. cit.*
[7] "Vital Statistics for 1885."
[8] *Op. cit.*, p. 208.

tunity to choose a profession also is generally associated with wealth and thrift, which represents ancestral effort, and increases with old age. The correlation is just as marked in one way of looking at it as the other. Both factors have probably had their due effect.

Involution. It must be admitted that the phenomenon of involution entails ultimately a general decay and weakening of most of the physiological functions. Height and weight decrease. Locomotion and digestion are impaired. The circulation is feeble, the temperature frequently lower. In many cases the blood becomes uræmic and venous. The arteries harden or the muscular coats undergo fatty degeneration. The testicles become dense and decrease in volume and weight, although spermatozoids are found in half the cases to the latest age,[1] some observers, however,[2] describing them as weak and languishing. The prostate frequently hypertrophies. The ovaries become entirely obliterated, and the vagina sometimes disappears. In the brain the cells atrophy and many of the associational fibres disappear, while the connective tissue hypertrophies and takes their place, or more or less hydrocephalus effects the same result. Ottolenghi[3] finds that sensibility to pain increases toward adult life and diminishes with old age, but that with adults sensibility varies more with social station and grade of degeneration than with age. In morbid cases melancholia[4] and dementia, in line with the general lack of susceptibility to acute diseases, is more frequent proportionally to other insanities than in earlier years. All the magnificent and touching poetry of the last chapter of Ecclesiastes is abundantly supported by the details of modern science.

As to the order in which this involution occurs, a great variety of opinions has been advanced. Reveille-Parise[5] thought that deficient oxidation connected with lessened vascularity of the respiratory organs was the first sign of failure, thus with the ancients making the breath (*spiritus animus*, etc.) the fount of life. Stephens ("Long Life") on the other hand suggests that excessive oxidation is the proximate cause of senescence, showing itself in dryness of the skin and wasting of the organs generally. The theories of Lendl, Dantec, Delage, already referred to, in regarding failure to

[1] Duplay, *Arch. gen. de Med.*, 1843, 1855.
[2] Reveille-Parise, "*Traité de la Viellesse*," Paris, 1853.
"*Das Gefühl und das Alter*," *Zeitschrift für Psy. u. Phys. der Sinnesorgane*, Jan., 1896.
[4] Sixty-seven per cent. according to Fürstner, *Arch. für Psy.*, pp. 465.
[5] *Op. cit.*, p. 36.

carry on a chemical process as the ultimate cause, involve respiration as only one of the necessary conditions. Hamelin thought the continuance of ossification, especially as affecting the thorax, as the essential point of departure. Cazalis, followed by many others in more recent times, regarded arterio-sclerosis with its consequences of renal and liver disease, cirrhosis, toxic blood, and various kinds of apoplexies, as the starting point of senility. Bouchard thinks that old age begins with a failure in nutrition, and traces diabetes, gout, obesity, etc., to this source. This, as Andre[1] points out, is hardly a distinction, the question rather being, where does nutrition begin to fail? In answer to this Tilt,[2] basing his opinion on a large collection of cases, refers the initial failure to the sympathetic ganglia which innervate and control the blood vessels of the great viscera, an involution which is first shown in the reproductive functions. Following Haller, he regards the sympathetic as an off-shoot of the cerebro-spinal system, an opinion which is supported by the facts of recent embryology. This failure in the sympathetic shows itself about the time of the grand climacteric in general malaise, sleeplessness or excessive sleep, blushings, slight nervous troubles, with their psychical correlations of uneasiness, irritability, slight melancholia. On the other hand the more serious nervous troubles, according to his carefully elaborated statistics, are much more frequent earlier in life. From an estimation of the cases admitted during ten years to the Bethlem Hospital for the Insane, he shows that liability to insanity for women is greatest at 36 to 40, and diminishes from 40 to 55.[3] He supports this by the fact that deaths from brain disease, as shown by the Registrar General's reports, are most frequent in women from 20 to 40, results in accordance with the statistics of Haslam, Pinol, Esquirol, and Foedéré. With men, the period of greatest liability is from 40 to 60. Deaths from all kinds of nervous diseases are only 13% of the whole, about half of which are due to infant eclampsia, and occur about 5 or 6. Of the remaining moiety, it is to be remembered that a large proportion, more than half, are directly due to arterial degeneration, and not primarily an affection of that portion of the brain which subserves the higher psychical functions,[5] while here, too, are to

[1] "*L'Hygiene des Viellards*," Paris, 1890, p. 36.
[2] "Change of Life," 1882.
[3] *Op. cit.*, p. 115.
[5] Cf. Age Curve given by Althaus, "Diseases of the Nervous System," p. 8.

be found the cases of phylogenetic degeneration evidently not due to the influence of old age.

By another way, however, through the support of the cerebro-spinal system to the sympathetic, the former may indirectly affect the innervation, the lack of which results in arterial aneurisms, lack of elasticity, etc.[1] Hammond, for example,[2] points out that traumatic lesions of the marrow are complicated with functional trouble of the cervical sympathetic. "These cases go to show that the cervical sympathetic draws a great part of its nervous action from the superior segment of the spinal cord." Claude Bernard[3] showed that if an animal was debilitated, excision of the cervical sympathetic resulted in mucous suppuration of the bronchi, etc., a trouble which Humphrey[4] notes as one of the commonest affections of old age. The value of the tone of the cerebro-spinal system to the height of the blood-pressure, proximately mediated by the sympathetic, is shown by Owsjannikow,[5] who demonstrated that removing layer after layer of the trunk causes a fall of manometrical pressure before the pons (circulation centre) has been reached. Gley[6] supplements this by showing that cutting off the medulla causes a fall in pressure, cutting out the spinal cord a greater fall, after which, however, contraction of the blood vessels was still possible in reaction to the injection of certain chemical substances, thus proving the partial independence of the sympathetic as well as the support afforded by the spinal system.

The importance of this connection is witnessed by many more purely psychological phenomena. Mosso ("*La Peur*," *e. g.*) has made special studies on blushing (less prevalent in age) and cerebral circulation. Careful experiments with the plethysmograph in many psychological laboratories have shown the almost instantaneous influence of psychical impressions on the circulation of various parts of the body.

In face of death by starvation, the most typical of all forms of death, it has been abundantly demonstrated that while all the other organs of the body gradually atrophy, the heart, the kidneys, and more especially the brain, remain exempt.

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[1] The smaller vessels of the brain itself are not generally supposed to be supplied with sympathetic fibres, which, if a fact, would only result in making the strain of a weakening sympathetic fall primarily upon the other organs.

[2] "Diseases of the Nervous System," 1890, p. 866.

[3] "*Path. du Sys. Nerv.*," T. II., p. 535.

[4] *Op. cit.*

[5] Quoted by Meynert, "Psychiatry," trans. by Sachs, 1885, p. 206.

[6] *Arch. de Phys. n. et p.*, Brown-Sequard, 1894, p. 202.

As Mosso says,[1] "the last overflow of the vital material of the body is sent by the last heart-beat to the brain." He points out that increased nervous stimulability of the brain in face of starvation would be a favoring factor in natural selection. The flaring up of dormant faculties just before death is, no doubt, an expression of a similar condition.[2]

With the approach of old age there seems to be plenty of cases which follow an order of involution which is not descending. Muscular power, for example, generally fails before the capacity to direct the labor of others. Humphrey, from reports of 900 cases observed by medical and scientific men, notes "how many of the very aged are in good possession of their mental faculties, taking a keen interest in passing events, forming a clear judgment upon them, and full of thought for the present and future welfare of others."[3] Even in centenarians "the brain held out as well or better than the other organs."[4] In green old age (*age de retour*) there can hardly be any doubt that the intellectual qualities are even relatively improved. Balfour,[5] following Beneke[6] and other anatomists, points out a rather remarkable adaptation which favors the brain, namely, that while the other arteries of the body may be completely calcified, the internal carotids and vertebral, which feed the brain, normally remain soft and yielding. Towards old age also, the heart normally hypertrophies, beats faster, and correlated with these changes the blood itself actually increases in hæmoglobin, and when these changes do not occur at the proper age the whole physical and mental health suffers. Heart stimulants, *e. g.*, digitalis and strychnine, the latter of which at least acts primarily on the nervous system, are found highly successful, often changing at this period of life the anæmic and dejected individual into a healthy and active old man. The most commonly repeated difficulty of either the natural or the artificial adaptation for old age, appears to be degenerative changes in the internal arterial coats (which may be primarily caused by lack of innervation). These either by coming off in pieces and forming plugs, or by pocketing in weak spots (miliary aneurisms, *e. g.*), give rise to hemiplegias and apoplexies of various kinds. The maxim of Cazalis, "a man is the age of his arteries," although by no means applicable to every case, seems to be supported by greater numbers than the descending degeneration theory of involution.

[1] "*Die Ermüdung*," p. 285.
[2] Cf. Féré, "*Path. des Emotions*," p. 170 et seq.
[3] *Op. cit.*, p. 24.
[4] *Op. cit.*, p. 48.
[5] G. W. Balfour, "The Senile Heart," 1894.
[6] "*Die Altersdisposition*."

Even in the etiology of the distinctly mental troubles of old age, recent opinion shows an increasing tendency to give a large place to causes of a somatic nature. Of mental diseases generally, Dr. Rohé[1] states that the view that many mental disturbances are due to auto-intoxication is gaining ground among alienists, and cites to this effect Price, Kerkley, Lash, Emminghaus, and Kraepelin. Norberry[2] claims that "senile dementia" covers diseases "essentially different in nature and symptoms." J. A. Houston[3] examined the blood of fifty-two melancholiacs, and found hæmoglobin deficient in every case. The editor of the *Jour. of the Am. Med. Assn.*[4] thinks that most of the cases of mental confusion in old age may be due to uræmic intoxication. Ludwig Wille[5] ascribes the pathological mental involution as originating in "derangements of the circulation and nutrition of the central nerve substance caused by the morbid condition of the organs of circulation," a view in which Kraepelin in his chapter on old age coincides.[6] W. F. Farquharson[7] analyzed 230 cases of melancholia during twenty-seven years, and says, "Leaving out of consideration hereditary disposition and previous attacks, the cause of melancholia was found in a marked preponderance of cases to be of a physical nature." Nötzli[8] brings to view the great prevalence of lesions due to arterial degeneration. He carefully weighed the different parts of the brain in 110 cases, and found that the cortex lost considerably less than the basal ganglia. Within the cortex the frontal lobes did not lose more than the occipital. Senile dementia is, however, in the most of cases more probably a phenomenon of phylogenetic degeneration, and is not to be regarded as a peculiar characteristic of old age. Krafft-Ebing and Lombroso claim that senile dementia is more frequent with the morally insane and born criminals than with other classes.[9]

From these facts it would seem as if Roux's conception of a liberating stimulus to the lower ranges of assimilation originating in and controlled by the highest work-product, would be fulfilled by some such relationship of the cerebro-spinal and sympathetic nervous system as Tilt suggests, when the stimulus to nutrition is to be regarded as the last or the most

[1] "Mental Diseases," *Medical Annual*, 1894.
[2] *Hosp. Bulletin* of 2nd Univ. Hosp., Aug., '92.
[3] *Boston Med. and Surg. Jour.*, Jan. 18, 1894.
[4] "Psychoses of Old Age," Nov. 30, 1895.
[5] "Old Age and its Psychoses," Hack Tuke's Dict., p. 869.
[6] "*Kompendium der Psychiatrie*," Leipsic, 1883, p. 367.
[7] *Jour. of Mental Science*, London, Jan., Apr., 1894.
[8] "*Ueber Dementia Senilis*," 1895.
[9] Lombroso, "*L'homme criminel*," p. 569.

complete form of the general nervous activity, and that the body, as far as it is an organism, is so mainly because there is thus brought into immediate connection the extremest functions of the organism. The human body is, first of all, an organism, and the organs of relation are thus in normal cases the most permanent and enduring.

Despite these facts, however, since the days of Bichat and earlier, there have not been wanting authors, principally alienists, to hold that the failure of old age begins normally at the top. In the present times Ribot, Ross and Mercier have adopted this theory. Mercier[1] regards the essential phenomena of old age as a cutting off of the most recent and most highly developed brain layers. Old age is like a frost-blight, which nips the buds the latest grown. He and Ribot[2] also seem not to distinguish very clearly between the phylogenetic development, repeated and appropriated by the individual, and the mere repetition of actions in time in as far as this refers to old age. Memory of recent events no doubt fails in old age. But what evidence have we for supposing that these acts of memory presuppose any new brain growth, such as would be necessary if we are to use a simile like that of the budding tree, or the upper and lower brain levels of Mercier's theory? The really most recently grown structure (like the city which has originated from the surrounding country, used as a storage depot and an organ of control) may be just as permanent as any other, or more so, except under the strain of distinctly degenerative (phylogenetic) causes. No doubt in an ultimate sense we must admit the complete co-determination of structure and function, but this does not excuse us for running away with crude ideas of structure, wholly derived from the limited range of present observation. In brain matters particularly, our knowledge of function is vastly ahead of that of structure. Memory, it must be remembered, is no mere partial faculty. It is really a fundamental quality of all tissue.[3] And with the loss of memory that comes from hemiplegia and similar morbid causes, which give the greatest number of cases of aphasia upon which the strongest argument rests for degenerative senile involution, we have frequently a portion of the brain entirely destroyed, so that no vital quality, memory or otherwise is left behind. Where this focalized lesion attacks the language centres, there are no doubt many cases in which in a

[1] "Sanity and Insanity."
[2] "Diseases of Memory."
[3] "Memory in Disease," Strahan, *e. g.*

general way the degeneration begins at the top of these centres; but there are others where this does not seem to be the order followed, and besides this there are many cases, as Bastian[1] points out, "where aphasia has been most complete, but the mental powers have been well preserved." The number of cases, too, where the left brain (the centre of language) is affected do not seem to be the greatest. Brown-Sequard found, of 121 cases of hemiplegia, the left brain was affected in twenty-four, the right in ninety-seven cases.[2]

The normal failure of memory, so-called, in old people is really a failure of recollection of certain events in preference to certain others. This may not be due to descending degeneration. Recollection, while it presupposes memory, is yet something more. In the first place it depends directly upon blood circulation and drops out in sleep. Here it must be admitted that Mercier has the courage of his conviction, and is consistent with himself in saying that sleep itself is a form of dementia, indeed the "last and most complete stage of dementia known as coma,"[3] an extreme which surely indicates the necessity for more careful distinctions.

Old people may dwell upon youth and early married life because it was their happiest period, while, as far as we have any proof, this is the period of the formation of the highest layers, the latest buds, etc. The only way, if we are to apply recapitulation, is to compare memories, *i. e.*, capacities formed in early childhood with those later on while still in the course of recapitulated phylogenetic development. Beyond this period there exists a more purely ontogenetic development which has not had the same necessity for being so thoroughly established in philogeny, to which the criterion of race development does not apply to the same degree. Peculiarities of the individual, or of his immediate ancestry, as Roux and Darwin mention, come out more strongly. These of course may form the new material for selection and may result from a new creation, or from a pathological condition or decay. Geddes, indeed, is of the opinion that all sports or variations may be originally pathological. The beginning and continuance of senescence may thus be the most important of all the periods of life for the origination of fresh development. But in any case we are not in a position to apply the recapitulation theory.

Instead of a fresh budding of growth, the recollection of events may just as well be compared to the sending of a train,

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[1] "Paralysis from Brain Disease," p. 198.
[2] Quoted by Bastian. *Op. cit.*, p. 209.
[3] *Op. cit.*, p. 299.

for example, between New York and Chicago. That the train does not pass is no proof that the track is destroyed. There may be at the time or for short notice (the inelasticity of age) no coal or no crew. So no doubt in imperfect recollection we have a lowered state of the physical organism, which is similar to, and perhaps caused by, greater slowness and imperfection of digestion and circulation as well as by general physical decay, but which is no proof that there is greater structural or permanent functional impairment of the higher brain-paths than of others, or of the brain itself as compared with the rest of the body.

Here early writers, Bichat for example, seem to have initiated a faulty way of looking at the brain, in drawing so strict a distinction between the animal and the vegetative functions. Careful measurements now show us that in sleep, as in other lowered functional conditions, such as old age, the vegetative as well as the psychical functions are materially lessened, and we have no right to regard the plastids of the brain, which only more specially subserve animal or psychical functions, as not being just as vegetative and just as much organs of digestion as any others in the body. We have here not a question of specialized vegetative functions of the really living protoplasm. The plastids of the stomach, for example, are as capable of being starved as any other, since nervous stimulus is necessary for their activity, and the food which they use is furnished by the blood as for any other organ.

The body, although in itself an imperfect organism, is, in fact, as Roux insists, a collection of parts which are themselves again imperfect organisms. The vegetative functions, meaning by this simply the basal qualities of assimilation and digestion, belong to every plastid. Among these, however, a struggle for existence takes place, the results of which are more marked in old age than in any other period, but for the just estimation of which we must not confine ourselves to any one class of phenomena, and more especially when these are of an admittedly morbid, *i. e.*, phylogenetically degenerative character.

The truth seems to be that in the struggle for existence among the various organs, through the course of a life-time, certain of these, partly through hereditary strength, and partly through a greater compensation due to exercise, or for their opponents either over or under use, obtain an advantage over the others, which, when it becomes so marked as to deplete some other necessary organ, results at last in debility and death. The organism in old age thus loses its power of self-regulation and, as Johannes Müller[1] recognized,

[1] "*Physiologie*," Coblenz, 1844, Bd. II, S. 767.

is to be compared "more to an ingenious mechanism than to that basal form of the organic whole which produces the mechanism from itself, and makes it capable of compensating for its loss. Therefore in old age a very small outer strain is able to bring to an end the whole, as is the case with a mechanism."

Even when the good adjustment and balance of the several parts which are necessary to a healthy old age exists, "a time comes at length when in the course of the descending developmental processes, the several components of the machine, slowly and much, though equally, weakened, fail to answer to one another's call, which is also weakened; a time when the nervous, the circulatory and the respiratory organs have not force enough to keep one another going; when the wheels stop rather than are stopped, and a developmental or physiological death terminates the developmental or physiological decay. The old man who had gone to bed, apparently much as usual, is found dead in the morning, as though life's engine had been unable to repair itself in sleep sufficiently to bear the withdrawal of the stimulus of wakefulness. Or some exertion may be followed by too great exhaustion. Dr. Willis, the attendant upon King George III, at the age of 90, after a walk of four miles to see a friend, sat down in his chair and went to sleep, or was thought to be asleep, but he did not wake again. Or some slight scarcely noticed excitement may have the same result. A cattle dealer, aged 98, who attended Norwich cattle market on a Saturday of last year, soon after talking and laughing somewhat heartily with a few friends on the following Tuesday, was found to be dead. Or a slight indisposition, further lowering the status and force of some organ, fatally disturbs the feebly maintained equilibrium. A lady, aged 94, attended the early service at church, walking a distance of a quarter of a mile, to and fro, caught a slight cold and died in the night."[1]

Among the different organs there is none whose normal activity conduces more to the best balance of the various parts than does the brain. This, indeed, along with the storage necessary for such a task, appears to be its principal function. It is thus easily understood why the intellectual and liberal professions allow the greatest opportunity for longevity. Ultimately the forces of life are controlled and stimulated by the highest development of the work-product of assimilation, represented in our psychical life as thoughts and feelings. Intellectual labor, emotional susceptibilities, ideals and aspirations, and their wise direction by a fully

[1] Humphrey, *op. cit.*, p. 6.

cultivated art of education, are thus functions which without transcending the here and now of a strictly biological sphere, tend to increase the vigor and the length of life.

With the beginning of the grand climacteric and the increase of age, the individual qualities *per se* assert themselves, with of course only a relatively greater strength. These qualities are, however, formed in the earlier periods of life and in contact with the great passions which underly them, the brain, as the highest work-product of assimilation, offering the means for radiation. In these periods it has been necessary in the course of natural selection for the individual to be held under by the race. But with the age of descent he passes out to a certain extent from the protecting shadow of the phylogenetic life and becomes more ontogenetic and individual. Old age is the period of distinction. It is in line with this that it is a period of extremes among individuals, which may account for the fact that authors have differed so much in describing its features. Cicero, for example, praises old age, while Aristotle condemns it. Melancholy, irritability, egoism increases; so does good health, calmness, sacrifice. Samuel Rogers, the poet, said he never knew what health was till he was 55. It is the race life, however, that is normally the source of our greatest force and happiness, and old age is only successful when it has so absorbed this life that its more intellectual service becomes its deepest motive and highest happiness. In maturity we serve the race by the blind impulsion of instinct if in no other way, but in old age much more because we elect to do so. In this respect old age is really the test of life from an individual standpoint. Solon's apothegm, a man can never be pronounced happy until he is dead, had no doubt some such significance.[1]

The questionnaire. With the aim in view of obtaining a general picture of the common notions on the subject of old age, death and the future life, the questionnaire subjoined[2]

[1] Cf. George Meredith's poem on "Old Age."

[2] TOPICAL SYLLABUS FOR GENETIC PSYCHOLOGY.

(Second Series, Academic Year, 1895-6.)

IV. THOUGHTS AND FEELINGS ABOUT OLD AGE, DISEASE AND DEATH.

I. *As a child*, how old were people you thought aged? How long did you want to live? How did you fancy old people felt, thought, etc.? Did you love the companionship of any old people, and what traits in elderly people attracted and what repelled you?

II. As a child, when and how did you make your first acquaintance with death, with details, and how it affected you? What were your earliest ideas about corpses, funerals, hearses, coffins, shrouds, mourning, the grave, and what took place in it? Did you think of worms, bones, etc., or conceive the body as feeling cold, damp,

dark, or shut in and smothered down? Did you have spells of dwelling on such things, and did you develop any mental imagery of the soul in or leaving the body, or what it was, or where, or its state? Was it gaseous, luminous, easily blown away, bluish, heart-shaped, resident in the head or breast, or what?

III. What diseases did you fear most for yourself or others? How did you think they acted? What accidents or other death-bringing agents did you develop most imagery about? Did you ever fancy yourself either dead or dying? and, if so, tell all about it.

IV. When in your teens, or later, did you ever have spells of dwelling on death, coquetting with flitting suicide thoughts, or day-dreaming how others would feel or act if you were found dead, and, if so, were these feelings or fancies associated with anger, love or religion, or any other experience, and how? At what period of life have you thought most of these things? Under what circumstances have you ever thought suicide might be justifiable? How, when, and in what condition would you prefer to die? Have you ever been suddenly very near to death, and what were your feelings at the time and afterwards? What background feelings when a sense of the miserable shortness of life comes over you?

V. What used to be and what are your deeper and most instinctive feelings, thoughts or questionings about a future life for yourself or others, and what changes have these sentiments undergone? Are these things fixed beliefs or fluctuating with moods? and, if the latter, describe your different sets of psychic states. How long after death do your thoughts run, and what used to be your fancies about heaven, souls, angelic occupation, association with friends, etc.? Do you have two sets of feelings — one hopes, taught beliefs, and another to fall back on if the former should be more or less mistaken? and, if so, describe them. What is your feeling about the friends you have lost?

VI. Will you ask old people of your acquaintance to either write themselves or tell you whether they dread death, if so, why? What they expect hereafter if they dwell much upon it, etc.? Ask them if they would like to live their life over again if it were to be the same, or to go on to death, and what changes, if any, would make a difference with their answer. Ask what period of life they considered most worth living, and why. Also, what they dwell on most in the past. Ask about their sleep habits, and what they dream of, or what reveries they prefer to dwell in. Ask especially at what period of life they thought most of death. How they first realized they were growing old, and how each increasing sign of it made them feel, and especially ask them to state how the climacteric period affected them. Have they made wills, had life insured, directed about their funerals, and otherwise provided for the disposition of their body or effects, and if not, why not? Get any points bearing on what might be called the psychic phenomena of increasing senescence. Have they ever longed for death, or felt life a disappointment or failure hardly worth living?

VII. State any texts, hymns, phrases, proverbs, sermons, or literature, whether prose or poetry, or any expression or conversation, that have modified your feelings about these things. What is the best literature on old age you know? State also how loss of nearest friends or sudden death or prolonged suffering has affected your feelings. What, if any, *real* sources of consolation have you found?

VIII. State anything you know of the experience, past or present, of your confidential friends in these matters.

was issued some months ago by Pres. Hall and myself, to which were received answers from 226 persons. Our thanks are due to those friends who so kindly furnished us with returns, and in an especial manner to Miss Lillie Williams, professor of psychology in Trenton Normal School, by whose instrumentality a great number of them were obtained.

The returns altogether have furnished nearly 15,000 answers on various subjects, and as there were some 120 questions, it will be seen that on an average only a little over half of the questions were answered by each. About sixty per cent. of the answers were from females, and although these were kept separate in working up the returns, there was not found to be sufficient practical difference between the sexes in the ideas mentioned to keep them separate in this report.

The returns pertaining to childhood are specially valuable as they are derived from reminiscence. A person will generally tell what he thought as a child of such matters much more freely and without bias, than the child is able to tell himself, or than the adult will consent to tell of his present ideas. This latter point is indicated by the number who omit to give their present convictions with regard to the soul and the future life. The importance of child thought with regard to the future life has recently been emphasized by Runze.[1]

In making curves and tables indicating quantitative results, those only which are decided and emphatic are considered as of value in comparison. For this reason the percentages are

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IX. Always state age of every experience, also sex and nationality. Describe, briefly, health, temperament, complexion, size, signs of age, as baldness, decrepitude of any sort in walking, vision, hearing, memory, whether good looking or deformed, etc. Also whether married happily, how long, how many children, their health and success, what circumstances, friends, etc.

Send returns to

G. STANLEY HALL,
or COLIN A. SCOTT.

Clark University,
Worcester, Mass., Nov. 1, 1895.

N. B. Please answer as many of these questions as you desire; or, if you should wish to ignore the questions altogether, and communicate your impressions in your own way concerning any of the above topics, your contribution will still be of value, whatever form it takes. Every communication will be treated as strictly confidential, and in the report which will be sent those making returns, everything thought likely to betray the personality of the sender will be suppressed. Those not wishing returns can write anonymously.

[1] "*Psychologie der Unsterblichkeit.*"

kept in whole numbers. This perhaps should always be observed as one of the necessary safeguards of the questionnaire method. The individual cases, however, have an importance of their own, and sometimes the mere fact of a large number of erratic or unrepeated answers is not without quantitative value. These answers are on the whole like the sediment found in the bed of a stream, partly original or derived from the immediate surroundings, and partly the remains of ancient beliefs washed down by time, but full of fascinating problems for the psychological geologist.

It is interesting in this connection to observe that many of these beliefs show signs of weakening and decay. The limited number who mention hell, for example, indicates a considerable change from the days when, here in New England, the most widely circulated publication of its period (for 100 years, says Tyler) was a poem (!) by the Rev. Michael Wigglesworth. This production, which children were compelled to memorize, gives the course of an argument between unbaptized babes condemned to eternal damnation on account of original sin, and the Lord Christ, in which the latter obtains the best of the argument, but with a show of mercy concludes:

> "A crime it is, therefore in bliss
> You may not hope to dwell,
> But unto you I shall allow
> The easiest room in hell."

Rubric 1. Child's Idea of the Thoughts and Feelings of Old People.[1] Here it is perhaps natural to find that 80% of those who give returns on this point (104) take a pessimistic view. Of these 24% pity old people because they could not run and play; 12% thought of them as tired and stiff; 14% as weak, miserable and unhappy; tired of life, don't enjoy, indifferent, 14%; felt in way, 6%; thought of nothing but religion, reading the Bible, praying, and what they would do in heaven, 13%; nothing but read papers, sew, knit and can preserves, 12%; cross, 7%; thoughts of death, waiting for death, 19%; wishing they were young, 11%; as willing to die as live, 3%; want to die, 2%; died when they made up their minds to, 1%; rather be a little infant than die, 1%; were solemn, gloomy, stupid, sorry, sad, lonely, sleepy, conceited, jealous, 16%; didn't want others to enjoy, 3%; thought of nothing but the wrong things little children did, 2%; that nothing could hurt them, they could not cry, 3%; did no wrong, 1%; didn't know if they did feel, 2%; never thought about them, 3%.

[1] Cf. Rubric 4.

Of the 20% who took an optimistic view, 8% thought of old people as happy, that they were wise and knew everything (weather, *e. g.*), 7%; pleasant to have some one wait on you, 2%; do what they pleased, 2%; looked forward to the time they would be children (cf. Sully), 2%; preferred to be old, 2%; enjoyed watching children play, 1%.

It is evident from adding the percentages together that for both the optimistic and the pessimistic classes above mentioned, one person may contribute to more than one of the subordinate expressions.

Rubric 2. What Children Liked in Old People. Of 140 returns, those who mention gifts, pennies, candies and eatables were 34%; telling stories, 21%; stories of childhood not included in last, 16%; kindness and petting, 16%; those who played with them, 10%; gave means for games and looked on, 8%; gray hair, 15%; caps, 6%; aprons, 2%; let help, 4%; interest in the things the child did, 4%; indulgent, 4%; intercession with parents, etc., 4%; advice, 2%; looked neat, 2%; cleverness and knowledge, 2%; restfulness, 2%; never got angry, 1%; loved to be with, 7%; preferred to children's society, 7%; no traits disliked, 4; generally liked, 21%.

Sub-rubric. Individuals mentioned as specially liked were 45 in number. Of these a grandmother was mentioned 24 times (or by 24 individuals); a grandfather, 10 times; some old woman, 7 times; some old man, twice; an aunt, once; and an uncle once.

Rubric 3. What Children Disliked in Old People. 140 returns. Wrinkles, 24%; untidiness, clothes, etc., 12%; tobacco chewing, 11%; tobacco smoking, 2%; snuff-taking, 1%; tobacco in any form, 5%; liquor drinking, 1%; slow and tottering gait, 10%; trembling voice, 5%; slobbering, 4%; eating habits, 3%; forgetfulness, 4%; cross and scolding, 5%; bad pronunciation, 2%; whiskers, 3%; bent form, gums, loss of teeth, 8%; sunken eyes, 2%; matter in eyes, 2%; gray hair, 3%; advice, 2%; kissing, 2%; no traits liked, 2%; generally disliked, 10%.

Sub-rubric. Individuals especially disliked, 10%: old woman, 3 times; old man, 3 times; aunt, twice; grandfather, once; grandmother, once.

Rubric 4. As a Child, what Age in others was Considered Old. 75 cases.

Average of	24.5 years	53%
Average of	47.3 "	35%
Average of	60.6 "	12%
Total average,	37.3 "	

Sub-rubric. Other indications of age besides years. 24 cases. Of these white and gray hair was the sign in 12 cases;

4, confused old with grown; 5, had no signs of age; 1, judged by trousers and long dresses; 1, by a full beard, and one thought that after a certain age a person did not get older.

This rubric may be compared with Nos. 1, 2 and 3, where it is probable from the character of the answers that those making returns have in view in the most of cases a greater age than the total average of 37 years given in rubric 4. It is, however, quite plain that children, although they no doubt discriminate the ages of their companions very keenly and even jealously, have a very hazy idea of the ages of adults. Up to the age of 17 the first of these characteristics shows itself. Seven of those who answered the questionnaire were careful to say they were 17½ or 17 and so many months. From 18 on there was no division of the years in giving the age. There is of course abundant reason for this in the rapid changes which characterize this period of life.

Rubric 5. Wished to Live to what Age? (*As a Child.*) 110 returns. Live to 100, 20%; several hundred, 1%; as far as could count, 1%; to average of 20 years old, 14%; to average of 69, 25%; (*total average of foregoing 111 years, by 63%*); live forever, 9%; no idea how long, 4%; till end of the world, 2%; be the last alive, 1%; very long, 2%; at 40 (the pleasures of life then over), 3%; "not longer than" an average of 56, 4%; when old get little again, 2%; when mother died, 1%; extinguished when too old to go school, 1%.

These five divisions may be more concretely illustrated by the following quotation from a return made by H. B., a lady of 33, happily married, with four children. This return is particularly interesting as showing the transition of the child's ideas towards those of adolescence. It is evident that the dwelling on length of life in this case takes the place of dwelling on death referred to in the table on that subject, and comes in at the same age:

When about 12 to 15 I always wanted to live till I was very old. It used to give me great pleasure to count the years by tens, because ten years seemed such an immense long time. In 10 years I'd be 25, and beginning the life I wanted especially (that is, my marriage, which was always the beginning of my life). In 10 years more, 35. It would take such a long time to pass. In 10 more I would be 45, and if I once could live to be 45, and go through the experiences I wanted, having a husband, a home, and children, I felt death would not be a great terror to me, but I felt it would be a terrible thing to be born and live, and not go through these experiences. I used to think (12 to 15) that death would not be so bad if I had my very own, part of myself, *i. e.*, husband and children, to die with, and I feel this yet. When I would try to reflect—now you might die and not have this experience,—it is impossible to describe how terrible it felt to me. I felt it would have been in vain

to be born. But if I reached 45, death would be robbed of its terrors. (I don't have this feeling now, but would like to live to 75 at least.)

After 15 I felt (with a little scornfulness) that it would be *impossible* for me to die—that it was certain that I would have these experiences that I longed for.

At this time these emotions were played on a good deal by religion. I frequently attended class meetings, revivals, etc. My companions were converted and tried to impress upon me that I was not saved. I felt if I was a Christian I would have to make the greatest sacrifices, do without gloves, etc., and would have to influence other people to live good lives, and I did not feel able at this age to do so. But I thought I'll live a good life now, but I'll postpone conversion till after I'm married. It will be so easy to be everything good after one is married. That would be a solving of all questions. Marriage was to be the opening up of my life in every respect: conversion, morality. I felt that I was willing to do all these things when I entered the married state. The texts, "Her daughters shall arise and call her blessed," and "Her husband shall sit on high places," used to thrill me. It makes me smile now—I was so young to be thinking of such things.

At this age and before it, I had no special reverence for old age. I thought it was a deplorable state to be in, and old people were always comparing themselves to their own disadvantage with youthful people—that it was always in their heads. But I used to try to make things easier for them. Knowing that my father (then about 60, and he is still living), had an aversion to speaking of old age, I never liked to have any one allude to it in his presence. When I was very young I noticed how his shoulders stooped, and used to like to take off his boots and put on his slippers. I wanted him to know that I loved him, and this was my way of expressing it. He never used to ask me, but thanked me, saying, "That's the lass!" but yet I never did it for the praise, but to show him that I loved him. I would follow him to the hall door and see that his coat and hat were brushed, and took a pride in seeing him look young. I even brushed his boots so that he would not have to bend his back. The brighter I could get them the happier I would be. The boys, my brothers, wouldn't do it. I used to bribe the boys, give them things of my own, and plead with them to cut the wood, etc., so that father would have no anxiety. I used to try to economize on his account. I did all this with mixed feelings of love and pity, used to sob for his old age. I never experienced anything of this kind with my mother.

After 16, when I was beginning to get introduced to young men, I began to get more selfish, and to think more of my personal appearance, but I could not bear the thought of my father dying. I used to sob and cry often with the thought that my father was old and did not have many years to live.

Rubric 6. Wished to Live to what Age? (As an Adult.) 48 returns. Before feeble or very old, 32%; when work or ambition is complete, 20%; in midst of work, 2%; average of 60 years, 16%; to 100 years, 2%; as long as possible, 4%; when old, 6%; never die, 2%; never thought of it, 10%.

Rubric 7. Aged People's Desire for Life. 16 cases, of an average age of 76 years. Would not care to live life over, 94%; would like to live life over, 6%; longed to die, 70%;

have not longed to die, 30%; thought most of death in later years, 44%; most in childhood, 14%; life best worth living in youth and early marriage, 60%; not worth living now, 14%.

Illustrative case. Married male, 65 years old, does not believe in future life. Have asked several old people, myself included, whether they would like to live their lives over again if it was to be the same, with the same trials, temptations and struggles for an existence. Most every one says "go on to death." Some think if they had their present knowledge they might try again.

Rubric 8. How Prefer to Die? (Adults.) 98 returns. Average age, 22%; short illness, 35%; suddenly, 21%; by lightning, 3%; drowning, 3%; long illness, 1%; old age, 4%; consumption, 3%; when conscious, 8%; unconscious, 5%; with no pain, 9%; ready to meet God, 5%; heroically or in some cause, 3%; surrounded by friends (grandchildren mentioned by two young girls), 23%; at home, 6%; away from those who would feel badly, 1%; at sea, 2%; no preference, 1%. Newsholme's[1] notion that the most of people would prefer to die of old age does not seem to be borne out by these returns.

Rubric 9. The First Impressions of Death, the Grave, etc. On this topic the returns are remarkably numerous, being 204 out of a total of 226. They are also very full of description, often descending to the minutest detail. 98 of the returns do not give the date of their earliest impression. This fact is of importance in comparing the relative numbers of the unfavorable and favorable mentions of table on pages 93-94, with the curves representing the results in the dated returns. It will be seen that the increased age has increased the unfavorable mentions.

The following condensation of a number of cases, where M. stands for male and F. for female, will give an idea of the material used:—

F.—1. Hearses pretty; wondered why we never went to drive in one; fond of mourning; wanted to have a black dress; grave a place where they put the body till the judgment day, when it was resurrected; never thought of worms. *F.*—2. Thought God came and took you out of the grave shortly after you were covered up; thought three or four days after a person was buried, he left the grave by an underground passage, and went to heaven in the night time when it was dark and no one saw him. *F.*—3. Thought it lovely to have a new dress and a long, black veil; always desired to have a doll with a full mourning suit. *F.*—4. The night a person was put in the grave an angel would come down from heaven and cut the soul out and fly back again. *F.*—5. Funerals unpleasant because every one wore black; coffins pretty with their dark wood and pretty handles. *F.*—6. Would look in the shop windows and pick out the prettiest coffin for grandpa when he died. *F.*—7.

[1] Vital Stat.

Hated to pass corpses, or even see them; coffins extremely repellent; shrouds dreadful. *F.*—8. Sad when I saw a hearse; feared the pall-bearers might drop the casket; hated coffins for fear of being buried alive. *F.*—9. Thought corpses were wax dolls; must be so nice to ride in a hearse, because one could look out at all sides and see things. *F.*—10. Never afraid of corpses, and always thought they looked so nice and lay so *still;* could not bear to see coffin lid shut; thought coffins were pretty, but hated them for having a cover, so the person could not see out when in it; disliked mourning; people still and sad. *F.*—11. Used to play funeral; one would lie on a lounge, and we would pretend she was sick and go to see her; after awhile she would die, and we would all go and cry over her, and then we would take her by the feet and shoulders and carry her into a corner. Although I always thought it was an awful thing, I often used to play I was dead (when quite alone), just to see how it would feel; I would stretch myself out on the floor, cross my hands, and hold my breath as long as I could; then I would imagine people coming in the room and looking at me in my coffin and talking about me. *F.*—12. Thought clergyman was the dead man. *F.*—13. Crying a pretence. *F.*—14. Relatives' duty to cry till funeral. *F.*—15. Funeral an impressive social function. *F.*—16. Played that the corpse came to life and scolded those who said mean things about it. *F.*—17. Had no idea whatever connected with coffins, shrouds, hearses or the soul; I never gave them one thought. *M.*—1. Hearse nicest wagon at the funeral; wanted to ride in it. *M.*—2. When about 10 I was allowed to ride on a hearse; I have always remembered this as one of the greatest pleasures of my childhood. *M.*—3. Lived near a cemetery, and we children used to play with skulls and bones which were dug out when new graves were made; had an antipathy to the cold of a dead body; at 12 I made an effort to overcome this ridiculous feeling by going up to and touching the corpse of a man who had committed suicide by hanging; I was unwilling to recognize the feeling of antipathy as natural to me. *M.*—4. Thought the women who cried at funerals were "taking on," to make a show and impress people. *M.*—5. Disliked funerals; liked hearse; disliked mourning; liked coffin; disliked grave. *M.*—6. Mortal dread of coffins; horrified by seeing an undertaker lie down in one. *M.*—7. Liked to see box lid lowered and earth shoveled in.

A good many mentioned that they tried to cry, and a great many spoke of curiosity as their dominant feeling.

One of the most striking things that comes out in this part of the material is the apparently unfounded way in which in the same individual some things connected with death, funerals, etc., are favorably regarded, and others put as positively disliked. Of the 98 undated returns, no less than 40 are favorable to some of the items given below, and unfavorable to others; 23 are wholly favorable to everything mentioned, 30 are wholly unfavorable, and 5 are neutral or indifferent. The following figures represent cases:

	Favorable.	Unfavorable.	Played.	Never Thought Of.
Coffin,	9	22	2	4
Funeral,	16	17	12	1
Hearse,	25	16	—	3

	Favorable.	Unfavorable.	Played.	Never Thought Of.
Wanted to ride in,	13	—	—	-
Mourning,	11	14	12	1
Corpse,	7	14	7	2
Grave,	2	14	included in funeral	1
Shrouds,	6	7	—	-

From the 106 dated reports of first impressions a set of curves has been drawn, in which the horizontal lines represent *cases*, mentions, etc., not per cents., and the vertical age in years. What is meant by a detailed and strong impression may be illustrated by the following:

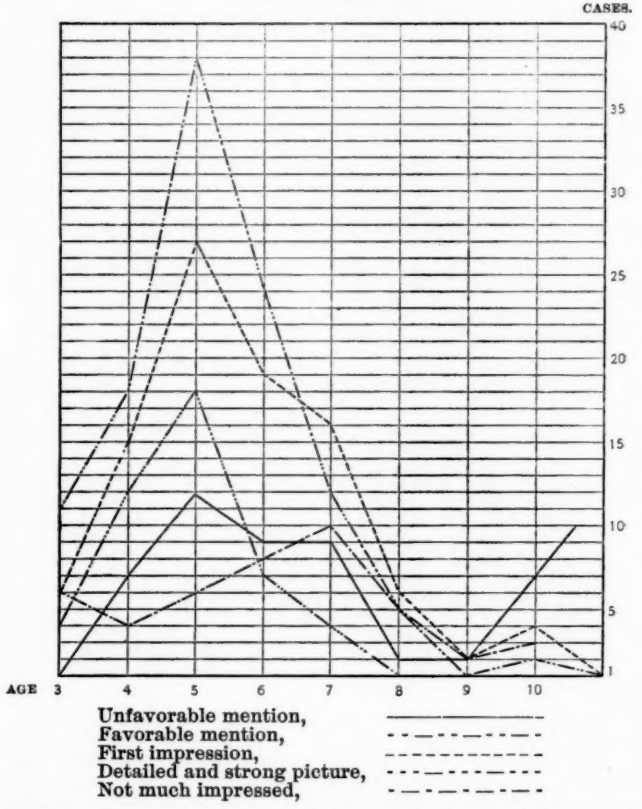
F. When I was 5 years old I received my first impression of death. An old Catholic lady coaxed me to come in and see her dead son in his coffin; I distinctly remember the room and the position of the coffin; she had candles burning on the table; around the coffin there sat about half a dozen women, who were showing their sympathy by weeping and moaning; the old lady took me by the hand and led me up to the coffin; I remember that he wore a shroud; I looked at the face and drew back, as his eyes were not completely closed; I cannot say I was afraid; I think it was more surprise than anything else.

Favorable and unfavorable "mentions" refer to the seven items in the table above, a much larger proportion referring to the dead body than before. It is evident that the number of "mentions" are in excess of the cases. Comparing the area enclosed by the "favorable mention" curve with that of the "unfavorable mention" one, it will be seen how much more numerous the first class is than the second. It will also be seen that the first class has a very decided apex at 5, while the apex of the "unfavorable mentions," although it occurs at 5, yet rises beyond the others at 10. The fact of the apex of this curve occurring at 5 is evidently due to the large proportion of all first impressions occurring at this age. These curves show most emphatically that the age for obtaining the first impression of death is generally at 5, and that if delayed till much after this age, it is much more likely to be an unfavorable one, sometimes giving rise to a horror which is never overcome.[1] The curves representing "strong and detailed impressions," and "not much impressed," support the above conclusion. The impression referred to is always of a very material or external character, and quite frequently visual. The grief of the mourners is not understood. Later on the external impression is not stamped with the same force upon the memory, but other things come in. The only

[1] Tolstoi's description of a young child's horror at seeing a corpse ("My Boyhood") is certainly not accurate in point of age if intended to represent a typical case.

mention of any grief being felt, is in this later period. It seems that the event meets with a wider psychic irradiation, a fringe which drafts off the concentration on the mere external facts and gives an internal emotion of grief and sym-

106 DATED REPORTS.



pathy, or sometimes horror and disgust. Both the more objective and the more subjective elements must play together in any future experience of death, and since the extravagances, the unnaturalness and morbidity frequently connected with the experience of death are highly subjective, it is surely of the greatest importance, pedagogically,

that the objective element obtain its due reinforcement at the proper age. The complaint of the little girl[1] on being refused permission by her mother to look at a corpse, that she "was six years old and never saw a dead person," has evidently its justification in the psychological constitution of the individual.

The following cases, both dated and undated, taken almost at random, will illustrate these conclusions:

F.—1. At 5 my brother died; I cried because the others did; remember great joy on driving to the cemetery at the signs of spring all about; I remember the patches of green grass or winter wheat, and bits of blue sky, but not the burial. *F.*—2. First acquaintance with death at 5, when a baby brother died; I recall how he looked now as he lay in his little white casket; I was not at all afraid, but rather liked the idea of looking at him; he looked to me as if he had fallen asleep among flowers. *F.*—3 (undated). One noon several of the girls from school went with me to see a boy who was going to be buried in the afternoon; I always liked to kiss every corpse, and I did so this day; when I did it all the girls did the same; when they came out of the house they were very angry with me for kissing him; they said if I did not commence it they would not have done it; they told me I had no right to do it, because he had the jaundice and we might get it. *F.*—4. Thought dead people were only asleep, and if one touched them or made a noise, or even talked, they would awaken; but I did not think they would hurt anyone, but only scream, and look and act like a crazy person. *F.*—5. At 6 first saw a little dead girl; was not afraid of the corpse, but was frightened at the darkness and stillness of the room. *F.*—6. First acquaintance with death at 5, when my grandfather died; remember well the darkened room, the coffin, the crying people; it was so strange that I rather liked it; I thought grandpa must like to be in such a handsome coffin, but would get out again when he wished to; I was impressed most by the odor of tube roses, of which the pillows were made; I have never since seen or smelt a tube rose without thinking of grandpa's funeral. *F.*—7. At 4, a pupil in my Sunday school class; a collection was taken for flowers; I was the smallest and laid the flowers on the coffin; after this I always liked to see funerals and corpses. *F.*—8. Death at 3, sister; mother said, "Bessie is dead;" could not realize what she meant, and although forbidden to do so because of contagious disease, I stole into the room and started to talk to her; I commenced to realize when she did not answer, but thought that she (psychic self) had gone away and would soon be back, so I saved parts of all my sweetmeats for her. *F.*—9. Did not know what a corpse was till my loved grandmother died when I was 10; I would not go into the room, although my feeling was not fear; when I heard she was dead, I did not want anyone to see me cry; I kept back the tears until I was alone; then I flung myself on the floor and sobbed to think that I should never see her again; I did not think about the funeral, hearse, coffin, etc., but spent my time watching how each person who came in the room acted; all the time I was putting myself in mamma's place, wondering how she felt, and what I should do if *my* mother died.

[1] Mentioned in returns, and reinforced by another similar case.

M.—1. At 6, father and two brothers died; it did not seem so horrid as I had heard. *M.*—2. At 4 attended funeral; thought corpse was only asleep; the blinds were down, the people walked softly and whispered because they did not wish to wake the dead; the preacher's text was, "He is not dead, but sleepeth." *M.*—3. Have the most vivid recollections of my first acquaintance with death (6 years); went at the invitation of a playmate to see their baby that had died; my feeling was one of curiosity; I thought the baby looked nice with a large gold cross on its breast; I remember feeling wonder that some women were crying. *M.*—4. First impression of death at 7; was taken to the funeral of an old lady; often heard of dead folk, and shuddered to think of one, and after seeing her I always disliked them.

Rubric 10. Ascribed Life to the Dead. (*As Children.*) 84 cases. Of these 30 cases ascribe smother feelings to the dead; 25, thought that the dead were asleep (sometimes breathing gently); 25, that the dead felt cold (in shroud, on ice, etc.); 16, that they felt rain, damp, etc.; 12, that they felt cramped, tired, wanted to turn, strange that they did not sit up; 7, that they felt lonesome; 11, were afraid that the dead would be buried alive; 6, that they were only pretending; 10, were afraid the dead would awake, jump up and do horrid things, run after them, play some joke; 3, spoke to the dead; 8, were afraid the dead would feel the worms biting and crawling; 7 more, object to the grave on account of worms; 8, feared the dead could not see out of coffin, grave, etc.; 7 more, that the grave was dark; 4, thought that the dead made their way out of the grave, dug, sneaked out in dark, etc.; 2, that the dead communicated underground; 4, that it was funny to put the dead in a coffin when they were going to heaven; 1, would rather have the body go to heaven and the soul stay in the grave; 1, thought the body kept on growing and would become the shape of the coffin.

The following selection from the experience of H. B. (already quoted) will indicate the transitions in the feeling of death from one age to the other, and give a concrete case referring to several previous categories:

About 10 to 14 I was frightened at any one who died; it was something I could not explain, although I used to try to reason myself out of it; I would look at a companion who had died and say: "Well, that was Alice; she saved my life once from drowning; I know there is nothing to be afraid of;" but yet I would have a feeling of terror, and I would shudder when looking at her, and for days after I would be afraid to enter a room alone; I used to go to sleep with my head buried in bed-clothes, frightened that if I would look up I would see the spirit of Alice in the room; to this day I have a similar fear after anyone has died; but it would be different with my own loved ones; I often thought when I was a young wife that it was strange I had this horror; but I liked to dwell on and imagine how, if my husband was dead, I would throw myself on him and clasp him—that I would be jealous of anyone

else—that I would go in and lock the door, and no one should touch or handle, or share the vigils till he left the house forever; I used to lie awake nights sometimes and think this way; I have had no experience of death in my family, but I know this is the way I would feel and act; but all other bodies would fill me with a nameless terror, all but my own loved ones—even I think I would be afraid of my own dear father; not what he is at present, but all that he has been in the past—the life of the man would rise up and terrify me.

Even at the present day when I see a hearse or crape, a shudder arises, and yet I am filled with a pity for the dead body that is going out; a feeling of suffocation and smothering, that the dead body must feel rebellious, overcomes me.

This return naturally introduces

Rubric 11. Dwelling on Death and Suicide. This is also a very well-filled category, 67% of the whole reporting. Of these only 7% of the whole state that they never dwelt on death or suicide, the remaining 60% giving answers like the following:

F.—1. About 15 I dwelt on death to the greatest extent; often thought of stepping in front of a passing train, drowning, taking poison, jumping from a window; often tried to decide if I committed suicide what way I would do it; often imagined how others would feel if I were found dead; once I imagined they were just lowering the coffin when I raised the lid; these feelings were associated at various times with all three—anger, love and religion; I thought most of these things about 15 or 16 and during revival services; at an earlier age, when I was punished. *F.*—2. Between 13 and 14 I had special spells of dwelling on death; after revival meeting, where were generally preached hell and judgment day, I thought of nothing but death; I came home and divided my possessions; I could not sleep at night; I was worked up so it almost made me sick. *F.*—3. Was very angry because my mother would not let me go on a picnic (at 14); I lay awake a long time at night and imagined I was dead, and that my friends all came to see me as I lay in my coffin; I thought my mother cried and cried and wished she had let me go to the picnic; so I felt revenged. *F.*—4. At 14 to 15, when very angry I used to think I would go and hang myself, at other times that I would jump out of the third story window; then I would imagine the horrified looks and the sorrow of those with whom I was angry, of what they would say, and how they would excuse me and blame themselves. *F.*—5. When stopped from quarreling with my sister, I used to imagine that my mother cared more for her than she did for me; this made me think I would commit suicide and so get out of the way; then I thought mamma would feel so bad, and my sister would never look the same girl again, and people would say, "What a shame that one so young could take her own life." *F.*—6. Angered and mortified by my parents upbraiding me (most about 13), I thought if I should commit suicide or some accident should happen to me, what would they feel and think? but when I imagined them weeping, I couldn't stand it and got as far from the subject as possible. *F.*—7. Once very angry with my mother; I thought, Well, I'll just go and drown myself, and then maybe she will be sorry; but then I thought it will be too late, for I will be dead. *F.*—8. Often after going to bed (when a child) I would lie still and straight, fold my hands upon my breast and im-

agine I was dead; I would think how the people would feel and what they would say when they saw me.

M.—1. At 15, often had spells of dwelling on death; how if I should be found dead, what would my friends say? *M.*—2. When angry or in an exceedingly generous or sympathetic mood, imagined myself dead. *M.*—3. At a co-educational school, the question was asked by a young lady, how many had ever thought of committing suicide? There were 11 of us, ranging in age from 16 to 20, and they all confessed they had contemplated it; this lady had asked 50 in the school, and with the same result. *M.*—4. At 14 and 15 I was much attracted by the girls, but was too bashful to say much to them, but I used to plan heroic sacrifices of my life in order to save them or ensure their happiness, thinking they would appreciate me then.

The difference of emotional depth in face of the thought of death between these returns and those of early childhood (rubric 8) is exceedingly well marked. In some cases love and even sexual love is mentioned, but even when feelings of revenge and ill treatment are the principal correlates, the altruistic tendency is quite as evident. There is involved here all along the putting of oneself in the other's place, and an assumption of love on their part which is appreciated by and reveled in by the miserable imaginer. By this logic of the emotions the heart gets back the love from which it seems excluded, and thus helps to cure its psychic wounds. The more intellectual radiation or reflection of F.—7, although it would seem to lie directly on the surface, indeed perhaps because it does lie simply on the surface, has only been mentioned once. The idea, too, that these imaginations are only a mere play, and that they would not really like to die, etc., is very rare indeed.

How common such experiences are, and how they culminate in early adolescence, with the awakening of the sexual and altruistic nature, may be shown by the following table:

Percentage who	No record.	In 'teens.	Below 'teens.	No date.
Dwelt on death (imagined, etc.)	0	62	11	27
Dwelt on suicide	69	27	1	3
Connect with anger	60	26	3	11
Connect with love	94	5	0	1
Connect with ill treatment	55	28	8	9
Thought others would be sorry for ill treatment	76	12	8	4
Thought how others would feel	38	38	4	20
Imagined with pleasure	92	6	0	2
Refer to as past (adults)	24	71	0	0
Say not yet past, 5%				

Rubric 12. Present Mention of Suicide. (Adults.) 65 cases. Suicide never justifiable, 34%; suicide permissible in certain circumstances, 60%; sickness or insanity were mentioned as an excuse by 12%; loss of money or like misfortune by 10%; wife running in debt, 3% (females); to get insurance for starving family a man may suicide, 1% (females); going to be hanged, 3%; sacrifice, pity (Jesus for example), 6%; loss of friends, 4%; frequently think of it, 4%; always prepared for suicide, 4%; only lack of courage prevents, 3%.

Examples of material:

F.—1. Age, 33. Since 16 have known I might become blind, and am prepared if this should occur to end my life. It has no more meaning to me than any ordinary preparation for any work. I think suicide is justifiable when circumstances make the continuance of life injurious to the health or life of others. If a person is justified in giving his life to save a drowning person, he is justified in preventing a long sacrifice of a useful life for a failure. The responsibility of ending one's life is less than that of producing life under ordinary conditions. F.—2. Age, 19. Suicide justifiable if it were the only way some real good might be done to others. Enoch Arden, *e. g.*, if his wife had discovered him. F.—3. Age, 36. English women in India at the time of the Sepoy rebellion.

M.—1. Age, 17. Justifiable if friends are against you in everything you undertake. M.—2. Age, 25. About 23 was subject to a periodical desire for death. I noticed that these spells usually preceded the expected arrival of a letter from a certain young lady. Usually when thinking of death now, it has a fascination I have to resist by force for fear of yielding to it. M.—3. Age, 30. To counterbalance effect of predisposition to depression, when taking life insurance I avoided those which gave payments in case of suicide. M.—4. Age, 35. Believing, as I do, that the end of life consists in the development of character in self and others, suicide does not appear justifiable to me. This does not prevent me from feeling at times that death would be a welcome relief from the difficulties of life.

Rubric 13. Feelings when Thinking of the Shortness of Life. (Adults.) 57 cases. Make good resolutions, 20%; think of wasted time, 12%; will be longer in the next world, 12%; life hardly worth living, 10%; sad and disgusted, 6%; troubles grow insignificant, 6%; life becomes insignificant, 4%; think of God as judge, 2%; feel glad, 4%; feel like laying up treasures in heaven, 4%; feeling of grim humor, 2%; a brake on all endeavor, 2%; wish I had never been born, 4%; never thought about it, 10%.

Rubric 14. Diseases, etc., Feared as Children. 129 cases. Small-pox by 30%; lockjaw by 28% (9% imagine getting it, 3% were ready with wood, etc., to put between their jaws); consumption, 27%; hydrophobia, 21%; railroad accidents, 18%; diphtheria, 16%; drowning, 15%; fire, 12%; leprosy, 8% (imagine getting, 3%); earthquakes, 7%; cyclones, tornadoes, 4%; lightning, 6%; pneumonia, 6%; cancer, 5%;

yellow fever, 5%; end of the world, 4%; feared to be last one alive, 2%; miscellaneous accidents, 6%.

The intensity of fears follows the following order: small-pox, feared *most* by 18% ; leprosy by 7% ; hydrophobia by 7%; consumption by 7%; lockjaw by 5%; diphtheria by 4%; cancer, 3%; yellow fever, 3%; railroad accidents, drowning, fire, each, 2%; earthquakes, cyclones, and end of the world, each, 1%.

The reasons given for the fears were: stories heard (newspapers, Bible, etc.), by 14% ; isolation by 10% ; become like lower animals, 7%; disfiguring marks, 6%; smothering, 6%; starvation, 5%; sure death, 3%; future life, 1%.

F.—1. I used to think I would die of consumption because I was very thin. *F.*—2. Feared being struck by lightning. I could imagine the zig-zag flashes cutting a way through the body like a spear and finally darting out, leaving its victim as dazzling light and completely isolated from everything. *F.*—3. Often (more about 7) if my jaws would not move as I thought they ought to, I feared I was going to have lockjaw, and starve to death. *F.*—4. Feared most enlargement of the heart, that it would keep on growing until it burst my body open and I would die. *F.*—5. Leprosy most. Afraid fingers would fall off. *F.*—6. Would worry myself almost sick when traveling, for fear the cars would run off the track. *F.*—7. Afraid of yellow fever. Heard father tell of many people dying from this disease. Would think how dreadful it would be if the people in our neighborhood would get it and would all die, and there would be no one left to bury us. Was afraid of hydrophobia, small-pox, diphtheria, scarlet fever, lockjaw, mumps, typhoid fever, being killed by runaway horses, hurricanes, war, earthquakes, thunder and lightning, of the water in the river rising and drowning us all, of fire.[1] At night I used to imagine I heard the fire cracking and snapping, and expected to see it coming up through the floor, but I never said anything about it.

M.—1. Feared greatly scarlet fever, also mortally afraid of consumption and catarrh. When traveling would think of train jumping the track. One of my greatest fears was lightning. I thought the souls of those struck went to heaven on the bolt of lightning.

Rubric 15. Experience when near Death from Accident or Disease. 25 cases. This rubric is of special interest on account of the recent article by V. Egger[2] on the consciousness of the dying, which has brought out some correspondence from other authors. M. Egger holds the view that the idea of death strongly stimulates the idea of self. The sense of merit which he admits is frequent in face of death is, he says, simply an epitome of the self. If we are to give any special meaning to the term self, this view is not borne out by the mass of these returns, some slight irrelevant idea, or the thought of others being most frequent. The sense of

[1] Most of these given in detail.
[2] *Rev. Phil.*, Jan., '96.

merit, if from one standpoint an epitome of the self, from another standpoint demands the recognition of others. This last element is most apt to be in the focus of consciousness. On the whole the most of the cases indicate the formation of a fetich or objective symbol somewhat de-centralized from a strong emotion, with which it is nevertheless sub-consciously associated.[1] This fetich is most apt to be some objective fact or sensation.

Drowning. *M.*—1. Thought of nothing but getting out, and if drowned would anybody be sorry, and would I have a big funeral? *M.*—2. All the bad deeds of my life flashed before me (14 years). *M.*—3. Nearly drowned. Thought of a great many things and suffered no pain, but hard or impossible to describe. *M.*—4. Nearly drowned while swimming at 14, but had no feelings about it. M.—5. Once nearly drowned (about 8 years). My experience was delightful, soothing, panoramic, and the tug of the rescuer was a harsh note, provoking a feeling of anger at the intrusion. *F.*—1. Once near to death by drowning; was physically afraid and trembled violently, but did not scream. The year before I had not taken algebra, as most of my class had done, and I thought, "Now it does not make any difference anyhow." *F.*—2. Nearly drowned last summer (age, 19); my head and brain seemed to be in absolute confusion; came to the surface once and thought, "Well, if my body is lost, my soul won't be."

Other accidents. *M.*—6. Nearly run over by train (under 20); did not think about anything till after, then pictured the possibility of death—body met at the station, etc.; then a rigid course of introspection to see what good I had done, what opportunities for so doing had been neglected, what evil I had done, and whether I would have gone to heaven or to hell; last, a renewed determination to reconsecrate my all to His service. *M.*—7. Near falling from apex of barn; felt no fear at the time, but was more thoughtful for a few weeks after. Nearly killed by a balking horse; only thought was, "Guess they'll have to get a new teacher." *M.*—8. At age of 24, half way up perpendicular cliff of 400 feet, commenced to reel with sun, heat and exhaustion, and felt like falling; have always been given to quoting poetry in predicaments; here flashed into my brain and saved me the words of Gunzalo, "Now would I give a thousand leagues of sea for one acre of barren ground." I somewhat queerly smiled. *F.*—3. Nearly run over; imaginatively impressed by the horse's hoofs for a week or more. *M.*—8. Shot in battle. Felt perfectly happy.

Illness. *M.*—9. Sick with la grippe (20); thought of meeting God, and did not feel equal to the task, yet, being so ill, it did not matter much to me whether I got better or not; when I got well I felt grateful to God. *M.*—5. (Same as above.) Near death from illness at 22; the danger disturbed me very little; I said, "I want to live long enough to do something in the world, but if Providence vetoes that wish—'Let 'er go, Gallagher!'" The half flippancy of my attitude surprised and shocked me afterwards. *M.*—10. At 22, after an attack of peritonitis, had occlusion of the intestines; my medical knowledge (physician) told me what it meant; it was probable I would die. This did not worry me, but I felt it would be the

[1] Cf. section on Fetichism in author's article, "Sex and Art," Am. Jour. Psy., Jan., 1896.

saddest thing for my parents, who had given so much of their time and fortune to me; the weaker I grew the less I worried about myself, and only the sadness mentioned remained to some extent. *F.*—4. Near to death lately (36 years); I was more blissfully happy than I had ever felt. *F.*—5. At 24 had typhoid fever; felt very weak; wanted to be let alone; felt it was easier to die than to gain strength. *F.*—6. Been at the point of death several times as result of *angina pectoris* and administration of ether; went (at 28) to a conceited young physician in a strange town to have ether administered, saying nothing about susceptibility; nearly died; first thought on returning to consciousness was, "That young fellow has probably learned a valuable lesson." Once had *angina pectoris* at altitude of 7,000 feet; during intervals of consciousness worried over a small bill that was left unpaid; thought Gabriel would have a good time hunting me up if they buried me in the mountains. During these gaps I have always noticed that all my senses, except the muscular, were very acute.

Rubric 16. The Child's Notion of the Soul. 102 cases. Substance, etc. Thought it gaseous, 26 cases; had wings, 17; light, 9; bright, 8; white, 9; invisible, 7; a bird (sometimes dove), 6; a bright light, 3; an angel, or like an angel, 6; no qualities, negative of all, 2; same as conscience, 2; bluish, 2; jelly-like, 1; a something, 1; brown, soft, about the size of a hickory nut, 1; a piece of flesh as big as hand, laid on shelves in heaven, 1; a thin white cloth, with black spots on for evil deeds, and flew around like paper, 1; a pure white ball of cotton, 1; oblong, dark, slate colored, lying across body, 1; small, hard, like wood, 1; an oblong, yellow, thin box, 1; part of Christ, 1; a cloud, 1; could stick fingers through, 1.

Location. In breast, 13; in heart, 7; around heart, 4; in head, 6; all over body, 10; not separate from body, 8.

Shape. Same shape as body, 20; heart-shaped, 10; same shape as body, but smaller, 7; body could be pulled off it, 1.

Capacities, etc. Floated, flew, etc., from body to heaven, 26; went from grave to heaven, 10; God or angels took it out of the body or grave, 7; joined new body in heaven, 1; joined old body in heaven, 1; watched for emanation, 3.

Never thought of the soul, had no idea of it, 14; have yet (as adults) no idea of it or think about it, 3 (females).

Illustrative cases. *F.*—1. Had no idea of the soul as being separate from the body; thought when the person died he remained in the grave for a while, and then got out some way and went up to heaven; it used to puzzle me how they got out without being seen and got their wings in order to fly to heaven. *F.*—2. Soul gaseous and bluish; of no definite shape; went through the body and air to heaven in the sky; all happened in an instant; when it reached heaven it took its place in my body again, as I imagined myself in heaven in bodily form; never thought my earthly body was in the grave. *M.*—1. Soul came out of the mouth, and if the head were put in something that would fit it very tight, the soul would not be able to leave the body and the person would not die.

Rubric 17. Belief in Immortality, 123 returns.

Percentage who	In childhood.	16-20 years.	21-40 years.	40-on.
Believe in future life	95	75	63	60
Mention childhood only	—	18	6	10
Do not believe in future life	5	7	31	30
Meet friends in heaven	29	29	27	20
Friends watch over us here, etc.	10	15	18	20
Accept or refer to hell	6	12	6	10?
Refuse to accept hell	2	4	—	—
No reference to hell	92	84	94	90
Heaven, city-like	15	4	—	—
Heaven, country-like	10	4	—	—
Heaven, a room	4	—	—	—
Heaven represented by throne	10	—	—	—
Thoughts run on after death forever	1	5	4	10?
Thoughts limited, difficult, close with judgment day	4	29	9	—
Heaven in sky, etc.	10	—	—	—

As the right hand column contains only 10 cases (more old people speaking of this life than the next. Cf. Rubric 7), the results are not very certain, except when they continue tendencies already shown in the first three columns. In the first column all the returns are represented.

Illustrative cases. *F.*—1. As a child I thought heaven was a place where they did nothing but sing, and as I could not sing I did not want to go there.

F.—2. Age, 22. Have a feeling that at times our friends hover around us; often felt that my mother was near me.

F.—3. Heaven (as child) a beautiful bright place, with carpet on the floor and no dirt.

F.—4. Somewhere between earth and heaven there were two paths, one leading up to a gate, another leading away from it; thought the soul in the form of a mist came up the path to the gate; there stood the judge; if good on earth they could go in; if not, they must go by the other path until they came to a large hole, and the soul fell through this into hell.

F.—5. Age, 17½. Thoughts are not very clear about the after life. . . . Hardly think we are to go there and just fly around like birds, but rather everyone will do the things they love best in the way of art or music, or anything of that kind; each will love all equally, and so there will be perfect happiness. . . . Can't realize that happiness goes on forever, and ever never changing; seems as though there must be an end to it sometime.

F.—6. Age, 21. Used to think, and do still, when I do not look at it scientifically, that heaven is up above the blue of the sky.

F.—7. Used to wonder what a person who was twice married would do in heaven.

F.—8. Age, 21. Idea of living on forever with my own personlity unbearable; I worried most about this at 10, but at 20 I heard an address on immortality; the feeling of its unbearableness came back; it was as if I simply could not endure it—better total annihilation, anything, than this continual going on and on; at present I do not believe in a future life.

F.—9. Age, 20. I used to think of the one who died as still in the grave, while taught the contrary; believe the soul departs to be with Christ.

F.—10. Age, 17. Always thought meet friends hereafter, bright and sparkling (fixed), crowded with people dressed in white, with gold stars on head; every one in heaven very gay.

F.—11. Age, 18. Believe fixedly in an eternal future in the presence of God; I think when a person is dead his thoughts are at an end, *i. e.*, *he does not think the way he used to*, but have no doubt the mind goes on in another life.

F.—12. Age, 36. Little feeling about friends who have died; feel that death ends all; if they have progressed we shall be outgrown; if they remain stationary they are outgrown.

F.—13. Age, 17. Imagined angels flitting about in long robes and watching the people on earth and carrying dead people to heaven; I *always want to think* that those who have died are watching over, protecting and guiding those on earth.

F.—14. Age, 18. Thought only a very few went to heaven, those who had been very good; thought heaven was like a large church, and that the people were clothed in white and sang to God, and He communicated with them; I think now that when we go to heaven all things which by faith we accept will be openly revealed to us by God, only in another way, and not as we now see them; the future we are told by God will be one of joy, but that joy will be different from what we now consider joy.

F.—15. Age, 19. Used to think every one who died went to heaven; don't now; angels spent their time singing, sitting around a throne and listening to Jesus; thought they looked after us, and were pleased when we did right (14 to 19); think of friends as happy and not far away.

F.—16. Age, 17. As a child I never truly wished to go to heaven, although I tried to think so; though I like singing I thought it must be tiresome to sing forever; now I think it is a place where we will be supremely happy, do everything we want to, but our wants will be so changed that we will wish for only that which is right; sometimes I have doubts concerning heaven, etc., but I should never care to speak of them to anyone whom I knew could not answer me, for if they could not it might strengthen these doubts, and would surely do another no good; I cannot in the least grasp the idea of eternity, and seem to think of it as only a short period.

F.—17. Age, 19. As a child believed in future life, etc., but at 15, when I began to think of such things, I had my doubts for a time; now my deepest thoughts and feelings tell me there is a future life; thoughts run only shortly after judgment day; heaven a great glittering palace paved with gold and jewels; souls looked just as they did on earth, etc.; I now feel uncertain what form my friends will have, or how we shall know them.

F.—18. Age, 17. Always believed in heaven; think of the body

in the grave for only a short time, then of the judgment day; I imagine when I die everyone else will die too, and judgment day will be soon after; heaven not very large, about like my room, only there was no floor, only clouds and God's throne, which was made of gold; people as on earth only floating around; there are times when I think heaven must be dull, and am puzzled when I think of the length of eternity.

F.—19. Age, 18. Gate of heaven large, beautiful, pure white, so bright it hurt your eyes to look at it; guarded by two angels, one outside with a large sword, and the other inside with the key which unlocked the gate; when a person died his soul flew to the gate, etc.; if the person had been bad, refused admittance, and the clouds opened up and he fell into hell.

F.—20. Age, 18. I imagined heaven was a big place, and that it was made of gold and marble; in the middle of it was a large throne in the shape of a circle; it was made of steps; on this throne sat God and Christ; before God there was a big book, and in this He had the name of every one in the world; when they did anything wrong He would put a mark opposite their name, and when they had so many marks, either good or bad, they died; Christ pleaded with God to let them come to heaven; on the steps of the throne sat a lot of angels playing on horns and harps; all around the throne were coffins, and in each sat an angel; all were singing, and they never stopped.

F.—21. Age, 17. I never *will* think and never did think of a future life, because the answer to all questions which arise is, "I do not know; no one knows;" after death my thoughts run only to the funeral; I never can think of what will happen to the soul, because I do not believe there can be a hell, although my religion teaches it, and I cannot imagine heaven.

F.—22. Age, 17½. My present ideas are entirely different; I think now the soul goes to paradise, and will go to heaven after the judgment day; paradise is very much like heaven, only not quite as beautiful; in heaven there is a river, and beautiful trees and flowers on its banks; but I seldom try to think just how heaven looks, because I know that "eye hath not seen, nor ear heard, neither hath it entered into the heart of man the things that God hath prepared for them that love Him;"[1] I pretend that I am sitting on the bank of the river with Jesus alone and telling Him how happy I am, and He is telling me why He sent certain troubles to me, and how they made me better; I know I will have a harp and can sing praises to Him; my thoughts thus run away into eternity; . . . . . I think the angels will minister to us there as they do now; . . . there is one question that bothers me, and that is, will mamma or my step-mother be papa's wife there? and what the one will do who isn't; . . . . I send messages to my mamma when I say my prayers, for I know that I can talk to God, and He can talk to mamma. (Father a clergyman.)

M.—1. Age, 33. Belief in future life and in recognition after death have been strengthened by the death of my little boy; I know that this is no intellectual evidence, but it is evidence that any heart will weigh well before rejecting; surely love of parent for child is a *real* thing, as real as the things we touch or taste; . . . . I see no reason why my love for my dead boy, and my desire to be reunited to him,

[1] Yet she often imagines that she will talk to Jesus and He to her, etc.

may not postulate the very existence of the objects towards which they are directed.

M.—2. Age, 65. Feelings have changed very much in regard to the future state (a phrenologist told me they would); can not think now that the soul can exist separate from the body, which will be decomposed in nature's laboratory.

M.—3. Age, 77. I have always believed in a future life—a blessed life for the true Christian, and a state of wretchedness for the impure in heart.

M.—4. Age, 35. Feel as if departed friends were near at hand looking down from above or just behind me, and interested in everything I do, more so than when alive; I like to think of them, and wonder what they think of what has happened since they died.

M.—5. Age, 35. Thought how sad it was to leave this world; never could get up interest enough in the future world to make me want to know more about it.

M.—6. Age, 25. In childhood immortality a necessary belief, and would have preferred hell to annihilation; at present, belief in immortality plays a very small part in my experience or motives; I leave it indefinite, though I rather *feel* it is true.

M.—7. Age, 25. As a child had the usual orthodox idea of a future life; later I lost belief in a future life, and have no desire to believe in it now for myself or for my friends.

M.—8. Age, 31. Fluctuate between the speculation that our elements are dissipated in death and a hazy hope that if we achieve self-knowledge in this state we may survive without losing identity; have lost only one friend by death, and I confess that I *feel* he survives in spirit, but I do not believe it (I do not mean that I believe in the contrary).

M.—9. Age, 26. During the funeral of my father I felt for the first time a certainty of meeting him again; about 17 the question of immortality was a favorite subject of reflection and reading; I became more and more satisfied that there was a life beyond, although nobody could demonstrate it; this was a spiritual but visualized existence; I saw myself with dear friends and with the great and good of all ages; wondered if Socrates and Homer would care enough for me to allow me to be near them; the death of a dear friend about year ago has profoundly affected my life; it seems as if a part of myself is gone, and that I shall never recover my wholeness until I am with him again; my disposition has changed, and I have lost confidence in my own abilities, but I have a deeper sympathy, and love friends more.

M.—10. Age, 30. The chief objection to the belief in immortality made itself felt in the fact that abortions, premature births, and deaths *intra partum*, do not cause the feeling of immortality; . . . the origin of life has been the greatest objection to my belief in immortality; my own life and my experience with so many dying and dead people since, have only confirmed my attitude, with which I feel perfectly happy, and which seems to me to lead me to a better and more rational life than any other doctrine; the only regret that I have is that I was allowed to work it out by myself with much loss of time and energy, and could not avail myself earlier of it.

M.—11. ———. No definite notion of future life; "forever," "eternity," seemed absolutely impossible; the idea painful; eternity presented itself visually as a vast expanse of unobstructed territory, bounded on the outer edges by a rim of forest trees.

M.—12. Age, 37. Never had belief in the heaven of the Sunday school pictures; I held the fables of literature in precisely the same seriousness as the stories of the Sunday school teachers; they seemed to me to be beautiful and good, but I hardly knew whether grown-up people meant us to really believe them; I never heard religion spoken of irreverently as a child.

M.—13. Age, 34. Always believed in future life, only momentary doubts or fluctuations; have studied, thought and preached on the subject, but think there is no proof; I *feel* that it must be true from my faith in God; can't imagine *time* in future state; never fancied much about heaven; expect to be greatly surprised by the nature of spirit life, but expect reason is immortal and the same; expect to see friends with *mind* only, and to *think* with them and enjoy their spirits.

M.—14. Age, 35. Have given up early idea of future life, but I think somehow spirit may be eternal, but I don't know whether the finite spirit will preserve its identity in the future state, or whether in some way it may be resolved into the infinite spirit; I like to think of both these possibilities, and of a third, viz., that the influence of one's life will continue to affect future generations of mankind.

M.—15. Age, 20. Sleep in grave till resurrection, and yet in some way believe to some extent that persons who are dead can know what we are doing; have heard, *e. g.*, a mother's parting words to her boy, "I will watch over you from heaven, my son;" heaven bright, no night, everybody joyous, golden streets; sort of ancient houses to live in, all through very beautiful; angels flew around all over world at command of Christ, not doing anything else, singing and playing a kind of harp; often imagined myself in heaven and looking down on earth and see the people I knew walking around.

M.—16. Age, 19. Feel death is a change for the better, but of that which follows death I find it impossible for me to think; I think we will meet our friends after death; I used to think heaven was a beautiful place, where you spent your time enjoying the different pleasures of life; I feel that our friends are around us endeavoring to aid us through life.

M.—17. Age, 26. Till 14 believed vaguely but confidently in a God and a hereafter; to-day, "If there is a God, the man who does the best he knows how here may expect some kind of a future life, in which he will know God better, and this existence will be in many ways better than the present; if there is no being above us, yet it will be better for himself and for others if each person does the best he knows how."

From a general view of the results of the questionnaire, we cannot fail to realize what an important element in the consciousness of mankind is the question of death and the problems which naturally arise from it. At first appreciated rather superficially and coldly by the child, the development of adolescence with its emotional crescendo adds an immense radiation of feeling to the objective facts, and at this age, rather than in later life, or even in old age, is found the most frequent dwelling upon these subjects. An ideal curve of the averaged thoughts and feelings on the subject of death and its radiations, during a lifetime, might be drawn, as rising to

the age of 5; dropping slightly and rising again to a much greater height at 14 (table), continuing with a slight fall for five or six years, falling as the practical side of life claims attention, to rise again slowly with increasing age. (Rubric 8.)

Immortality and the Funeral. With the fully developed concrete conception of death, there is evidently deeply associated on the one side a fringe of radiating ideas, and on the other the most elemental emotions of our constitution. At one moment an organized body, energetic, incalculable, awakening all kinds of reactions in our minds, is in the next simply a mass of senseless clay. All our feeling of continuity, of persistence of energy, as well as our feelings of love and sympathy, are shocked and outraged in proportion as we realize the facts. Death, the rude irony of its comment on individual life, its cruel separations, has been the tragic background to all the self-conscious development of man. "Why was I born to go through it all?" "I cannot bear to think of it," "I would rather never have been born,"—are typical of a number of our answers on this subject.

From the smothered sob which it has been said lies at the root of all religion[1] to the mother who still hears her dead child calling for her, or wraps a stick in baby clothes and carries it next her breast, death has shown itself to thousands as the very type of evil, the great imperishable blot on life. If we would live, however, it is necessary to be reconciled in some way to this great fact. Mystics have denied or glorified it, poets have covered it with tender words, calling it sleep, and crowning it with flowers; stoics have harshly dismissed the idea, or bitterly welcomed the thing itself as at least the end of its own fear. All of these tendencies are shown in our returns, but among those answering there is no reconcilement more frequently mentioned than the idea of the future life. In this respect the last two rubrics are more important than any of the others. In the ideas on the soul and immortality, we have summed up or represented elements which exist under many of the other heads. The association of growing old with death and the future life is one that is quite frequent. (Rubric 1.)[2] When a belief in immortality is reached, it evidently conditions the conception of suicide. The grave is not rarely looked on as the gate to heaven. The ceremony of the funeral, the weeping, etc., is looked on as "funny" by many children, and with astonishment by one

[1] Cf. "God is an unutterable sigh lying in the depths of the heart." Sebastian Frank von Wörd, quoted by Feuerbuch, "The Essence of Christianity," p. 121.

[2] "Let age approve of youth, and death complete the same." Browning's "Rabbi Ben Ezra."

adult of our returns, in view of the belief that the person has gone to heaven. The ceremonies of the funeral itself are frequently conditioned by ideas of the future life. The ancient Christians "testified their abhorrence of pagan customs of cremation by depositing the entire body in the ground."[1] Church burial has a similar significance. In Rome on their arrival at the church vault, bodies have their fine trappings taken off, and are piled one over the other, without a rag to cover them, until the vault is filled, when it is bricked up and left for fifty years.[2] From the mere fact of the wealth of material which it subsumes, the conception of immortality must be regarded from the psychological standpoint as at least a far-reaching synthesis of the imagination.

Perhaps because of its many sided origin there are very few ideas which have been more subject to various interpretations, and even to double meanings than that of immortality. Many seem to use it simply as a metaphor (as it may be Dante used heaven and Beatrice) for the undying ideals of the race, while others believe that not a nail or eyelash shall be lost when the body is awakened in a future world.

Much philosophy seems to have this idea as an all-transforming *arrière pensée*. Neoplatonism and Thomism, with the modern forms of scholasticism, are in evidence here. Plato has perhaps been unjustly drafted in to support the theory of individual immortality, although there are many passages suggestive of this idea, as Pfleiderer shows. According to Teischmüller,[3] however, Plato's ideas on this point are the same as those of Aristotle, although in a less developed state. The problem of Aristotle was of course concerned with universal immortality, the individual psyche dying with the body. With Plato senescence, death and immortality were so closely connected as to be identical in certain phases. Philosophy, as has often been noted, was to him a continual meditation on death. This meant that philosophy was a senescing or discarding of the material elements of individuation by reflection or meditation (method of generalization), which resulted at last in the "idea," which is immortal. To this, of course, there is nothing to be objected. It still takes place every day (if time can be applied). But for the individual as such, it is quite as justifiable to say that this immortal "idea" is death as life.

Kant, as is well known, based the necessity of immortality

[1] Tegg, "The Last Act," p. 68.
[2] Tegg, *op. cit.*, p. 125.
[3] *Geschichte der Begriffe.*

on the feeling for justice and self-completion, and in order to satisfy this demand he postulated the existence of God. Runze[1] points out that this conception of justice has been a more permanent historical motive than either the wish to live or the intellectual difficulties arising out of the conception of death. In days when enmity was wider spread, we find hell more popular, and almost a necessity to present satisfaction. In some cases, indeed, the joys of heaven were to consist partly in listening to the howls of the wicked, *i. e.*, other people who are offensive to the imaginer. The period of the foreign oppression in Judea before Christ, and the middle ages with their numerous wars and pestilences in presenting death in its most cruel and unjust forms, naturally resulted in the radiated conceptions of the future life taking a revengeful form. Jonathan Edwards in "The End of the Wicked Contemplated by the Righteous; or the Torments of the Wicked in Hell no Occasion of Grief to the Saints in Heaven," says, "When they have this sight it will excite them to joyful praises." "The damned and their miseries, their sufferings and the wrath of God poured out upon them will be an occasion of joy to them." Andrew Welwood (1749) says, picturing the future, "I am overjoyed in hearing the everlasting howlings of the haters of the Almighty. What a pleasant melody are they in mine ears! O, eternal hallelujahs to Jehovah and the Lamb! O, sweet! sweet! my heart is satisfied. We committed our cause to Thee that judgeth righteously, and behold Thou hast fully pleaded our cause and shall make the smoke of their torment forever and ever to ascend in our sight."

The philosophy of Fichte is very full of assertions and arguments in favor of individual immortality. The theory of Monads (Leibnitz), and modifications of it as held by Lotze, Krause, Pfleiderer, etc., lends itself naturally, as does the most of dualism, to the idea of a future life. The philosophy of Hegel, like that of Aristotle, seems to dissolve the individual at death.

Mosaism is remarkable in the lack of support it gives to the future life, as, indeed, is the most of the Old Testament. Contact with the Persian ideas during the captivity seems to have awakened this longing in the later Judaism.[2]

The teaching of Christ was certainly not markedly eschatological, the most characteristic passages having been drawn from Him only in response to caviling objectors. "The king-

[1] *Op. cit.*

[2] The oft-quoted passage from Job is translated by Rünze, *op. cit.*, as follows: Though after being flayed, worms destroy, yet in my bare (or skinless) flesh will I recognize (or acknowledge) God.

dom of heaven is now among you." The oneness of man and God was perhaps the pressing message of His best period.[1] To this "here and now" doctrine the Christianity of the middle ages presents a striking contrast.

Recent orthodox Christian writers show an increasing tendency to drop the notion of a direct continuance of the soul at death as due to Greek thought rather than to Christ, and to rely entirely upon the resurrection, which is to occur at the end of the world, and in which both soul and body are to be recreated. This, as Rev. Dr. Laidlaw,[2] *e. g.*, claims, is a view in harmony with modern psychology and with the revelations of the Bible.

On the other hand, from the standpoint of individual feeling, a considerable support is offered to the idea of immortality. In moments of greatest peace and happiness, an *Ewigkeit*, a feeling of eternal here and now comes over the soul, in which we find ourselves entirely absorbed with the present, and indifferent to or careless of death. Such a consciousness is fostered by all the higher services of art, religion, and the enthusiasms of love and noble work. It is not in these periods a question of the future, but the present is all sufficient and eternal in itself.

But when this feeling does not exist, and when we adopt the lower *jenseit* point of view, with this natural dualism is it not right and reasonable to carry with us a corrective derived from the higher state of feeling and project the idea of eternity into time? This Platonic lie, this illusion rather than delusion[3] has at least been the means of safety and psychic wholeness to thousands of the human race. Not from the technically philosophical standpoint, but from the artistic one of gaining the best and most harmonious effect of the elements within our control, from the standpoint of feeling and health, does this conception find one of its best supports.

In harmony with this view it is necessary to point out that the great fact which all these notions of immortality are intended to explain, and which they at least succeed in radiating, is the human experience of death. As Tylor[4] says, "Death is the event which in all stages of culture brings thought to bear most intensely . . . on the problems of psychology." As shown in our returns, death is on its first presentation to the mind almost unintelligible, and necessarily suggests some conception of continuity. (Rubric 9.) This is no doubt due in part to the presence of the dead

[1] Cf. Keim's "Life of Christ."
[2] "The Bible Doctrine of Man," 1894.
[3] Cf. the standpoint of Alden in "A Study of Death."
[4] "Prim. Culture," Vol. II, p. 448.

body, so strangely similar to its living counterpart. If death had involved a sudden material annihilation, the suggestion of continuity would no doubt have found much less hold upon the imagination. The conceptions of the lower races and the original ideas of children are triangulated almost entirely from the sensuous presentation of the dead body.

But with higher brain development and greater powers of representation, although still founded upon the primitive basis which normally should remain a part of the most advanced individual, there comes in another more important element. The dead body is not the only thing which has to disappear. We, who are yet alive, and have come in contact with the departed, carry with us impressed upon our minds certain ideas, trains of associations, complex reactions, which are capable of healthy action only in connection with the enemy, friend, hero, or loved one, who is now no more. It is necessary that this associative knot, or the brain region underlying it, should be gradually released and its energy radiated into other paths. Here the conception of immortality in suggesting the analogy of a journey, etc., assists in producing this result. The conception of meeting friends in heaven, which, as our returns show, is such an important content of the idea of future life, is felt in greater force immediately after their death, and gradually diminishes with time. The difficulty of running on in thought beyond a very few immediate events, such as the welcome, the judgment, etc., which, as our returns show, is in a proportion of 4 to 1, shows another side of this same question. On the whole, immortality, as reported in the present data at least, is a great deal less concrete than the present life. It is in fact a weakened repetition of the present, and as a weakened repetition tends to irradiate, dissipate, or discharge, the ideas which necessarily arise in the mind because the physical substrate or psychic mechanism, once formed, is but slowly modified in response to new conditions. This senescence and death of our own qualities are the natural consequence of the death of those whom we have known. Even if the idea should not gradually disappear, as we shall see later, it is at least (to say nothing of the ontology of the matter) a better economy of vital forces that it should be localized in the future and some distant place than that it should be ready to appear at any place and time.

But it is equally necessary to note that the idea of immortality has never been a perfect means of irradiation. There is still a very large residue of feeling, sometimes the greater moiety, which lingers round the body. The natural ascription of life to the dead still retains its hold upon us, even in face of a belief in immortality.

Here we may note as a very basal radiation of the experience of death the ceremony of the funeral. This ceremony, ostensibly undertaken for the benefit of the dead, just for this reason, in reality succeeds in focusing the associations connected with the departed in a suitable manner upon certain definite objective events. The bald intellectual perception or recognition of death does not sufficiently impress us with the reality of departure. The oration, which sums up the life and virtues of the deceased, the slow hypnotic movements, the solemn music, the measured tread, as well as the necessary expense which these entail, impress the imagination with the reality of the whole event, have a cathartic effect upon the emotions, and thus give a certain discharge to and assist in "reefing in" the associated ideas which naturally linger round the bodily presence of the dead. When these rites are the keys of large emotions, such as love, the irradiation is all the more important, and is powerfully assisted by the natural ritual of tears and sobs.

When for any reason this irradiation or discharge has not been accomplished, the centres or pathways connected with the old life, although out of connection with the present, are more liable to remain active, and thus become morbid and reactionary.

Here we enter upon ground which has of late awakened the greatest interest. The phenomena of second life treated by Benedikt (pamphlet), the auto-mimesis of W. Smith Baker, as well as a good deal of the current imitation theory of Royce and Baldwin, the double personality of Binet, Janet and Charcot, the hypnotic therapy of Krafft-Ebing, Hammond, Mœbius and Strümpel, the Dr. Jekyl and Mr. Hyde of some moralists, the conversion theory of Dr. James Leuba, and still more illustrative for our purposes the articles of Breur and Freud,[1] have their origin in similar conditions. These latter authors claim that the ordinary hysteria is quite analogous to the severer traumatic forms, both depending upon the non-healing of psychic wounds. Retention-hysteria is a term used by Freud to designate cases where often by strong compulsion of the will, the mind is so strained that although an objectionable idea is banished from consciousness, it has in reality been retained unconsciously and is the more dangerous since out of control of the other normal reactions. As he shows by many cases, this idea is capable of coming up in another form as a fixed idea or impulsive act, which seems to the patient to be entirely objective, and whose connection with his former conduct and experience may be quite unknown to him, but capable under hypnotic treatment

[1] *Neurologisches Centralblatt*, '93, Nos. 1, 2; '94, Nos. 10, 11.

of being revealed to the investigator, and frequently susceptible of cure. Cases of this kind are not infrequent, and especially in connection with the sexual life, whose morbid phenomena are so largely a matter of faulty radiation. A couple of his cases may be cited. One, of an employee who, after receiving ill treatment from his chief, had hysterical attacks, during which he did not speak or show any signs of hallucination, and of which he had no memory after passing through them. Hypnotized, however, and the attack thus occasioned, he revealed that during this time he lived through the scene where his master had attacked him on the street and struck him with a stick, while he was without means of obtaining justice or redress. Another, of a young wife who came to the physician complaining of an irresistible impulse to stab her 6-year-old only son and throw herself over the banister. She evidently honestly described herself to her physician as not being a woman of amorous tendencies, and as satisfied with her married life, but under hypnotization complained bitterly of the unhappiness occasioned by unsatisfied desires, and in this way accounted for her impulse to suicide.

In many of these cases the suggestion, while in the hypnotic state, of justification, or of carrying out in some way a natural reaction of the emotional condition, has been found to remove the morbid phenomena altogether. This cathartic method of treatment evidently points to the existence of a sort of morbid "pocket," or detached associational group, which thus becomes connected with a curative outlet for its activity.

Three of our returns on the subject of death report comparable phenomena. One, of a gentleman, afterwards a medical man, who claims to have seen the ghost or image of his uncle appear to him at night just before going to bed and when he was not thinking of him at all, although he had shortly before heard of his death. Another, after traveling some distance to see his mother, was too late for the funeral, but is positive that in broad daylight he saw his mother coming along the path towards him.[1] The third case is that of a gentleman who had just returned to his own home many hundred miles from the bedside of his mother, who was not expected to die for some time. She, however, died suddenly shortly after his return, and he was unable to be present at the funeral. Several nights after receiving word of her death, and without any special dwelling upon the subject, he was troubled with heart-rending dreams, in which he represented the body of his mother being torn from the bed on which he

[1] Cf. the file of similar cases reported by the Soc. for Psy. Research.

had last seen her, and dragged shamefully around the room. It may not be too much to suggest that in the cases described, since they were single cases in the experience of the individuals, the funeral might very probably have tended towards the prevention of these slightly morbid phenomena. Hedge[1] thinks that a study of the records of apparitions shows that they occur generally in daylight, and "that the best authenticated cases are those of living persons or persons *in articulo mortis*, or recently departed, and not of persons long deceased."

The naïve ideas of primitive people as revealed both in their conception of the soul and in their burial customs, which are much more than with us associated together, are most easily explained on the supposition of some such psychic mechanism as we have described. The Matambo (negro) widows, for example, "have themselves ducked in the river or pond to drown off the souls of their departed husbands who might still be hanging about them, clinging closest to their best loved wives."[2] After this ceremony they marry again. Some tribes drive a nail through the skull to keep the body down.[3] The burning of effigies when a man has died at sea or at a distance, is a common practice. In the graveyards in New England gravestones may often be seen in memory of those who have died at sea. Frazer[4] gives an account of an old historical custom that when a man turns up later on, he is not permitted to enter at the door, but must come down the chimney, and is clothed and fed like an infant for some time after. With the Iroquois a speech of condolence is made to the body of the dead chief, after which occurs the installation of his successor.[5] With the Algonquins a public address is also made to the body at burial.[6] Some Indians believe that the tears shed for the departed go to the other world. A child burdened down by the weight of a full tear-mug appears to her mother and begs her to cry no more.[7] The material buried with the dead are generally supposed to make him contented with his future life, and thus relieve the living from anxiety. The hell shoon of northern races were intended to expedite the departed in

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[1] "Ghost Seeing," *N. A. Rev.*, 133:286.
[2] Tylor, *op. cit.*, Vol. II, p. 23.
[3] James G. Frazer, "The Primitive Ghost and His Relatives," *Pop. Science Mo.*, XXVII, 668.
[4] *Loc. cit.*
[5] Horatio Hale, "The Iroquois Book of Rites," Phil., 1883, p. 60.
[6] Tylor, *op. cit.*, Vol. I, p. 481.
[7] Bastian, "*Eth. Forschungen*," Bd. II, p. 333.

his long journey, and thus helped to impress the imagination with his increasing distance from the living. With closer observation and a better discrimination of objective and subjective facts, these customs become more consciously symbolical, and thus show themselves all the better as radiations. Tylor[1] thinks that the custom of offering gifts to the dead has decayed. The modern Hindoo, for example, presents a small piece of woolen yarn to his dead parent and says, "May this apparel made of woolen yarn be acceptable to thee." The Chinese have reduced their sacrifices to a paper basis. For the benefit of their parents, especially, they burn mock money, "paper houses replete with every luxury,"[2] and other representations of everything supposed to be necessary for future existence. Paper is used to make the boats, which are furnished with candles, sent to sea and watched till they disappear, at the Japanese Festival of the Dead, or Feast of Lanterns.[3] Tylor says[4] that in "modern centuries the Japanese borrow money in this life to be repaid with heavy interest in the next." An inartistic custom of this kind must tend to break up the whole ritual.

At the present day the windows are left open after death for the soul to pass, and the body is carried out feet foremost, or with his face away from the door, a custom, of which although the meaning is now generally unknown, originated in the idea of preventing the dead from seeing the way back again. For the same reason in Ireland the body is frequently carried to the grave by a circuitous route. Among certain negro tribes a hole is made in the wall, out of which the body is carried, and which is afterwards carefully stopped up. Sometimes the body is run rapidly round the house three or four times, after which his ideas of locality are supposed to be uncertain.

When these discharging radiations did not occur, the association knot made itself felt in the seeing of ghosts and other similar phenomena. The ghost of a body which was unburied, or buried without the funeral rites, was believed by many nations to haunt the relatives of the deceased. According to the classical story, Eukrates' wife appeared and demanded the sandal which had not been burnt. The story of Periander and Melissa is similar to this. With the Iroquois, the soul remains in the neighborhood of the corpse and is restless till burial. In Brazil, the soul haunts the survivors

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[1] *Op. cit.*, p. 492.
[2] Tylor, *op. cit.*, p. 493.
[3] "Lafcadio Hearn," *Atlantic Monthly*, 68:382.
[4] *Op. cit.*, Vol. I, p. 491.

till burial. With the Acheron, the unburied wander restlessly around. With the Slaves, the soul flies around till the body is burnt.[1]

Those who had made a great impression on the community were of course the most difficult to keep down, and special ceremonies had to be undertaken. The followers of Attila, for example, turned aside the course of a river, buried him in the middle of it, and turned on the water. Murderers, even in recent times, were pinioned to the ground by a stake driven through the body.

The very frequent conception of three or four different souls shows the difficulty of radiation under one idea. These souls come in just where the old associations connected with the dead would be touched upon by various objective facts or conditions of the environment. With the Siamese one soul stays in the house, one in the cloister, one in the wood, and one wanders around. With the Fijians, the shade goes to the under world, the bright spirit remains by the body. With the Dakotas, one soul remains in the village, one in the air, one goes to the spirit land, and one remains by the body. With the Khouo, one soul dies with the decay of the body, one remains in the race to be born again, one is taken by Bura, and one wanders around. With the Malagese, one goes in the air, one dies, and one haunts the grave.[2] The Latin, *spiritus, manes, umbra;* the Greek, *psyche, nous, pneuma*, and the Egyptian, *ba, akh, ka, khaba*, or soul, spirit, life principle, shade, played a similar part in their mythologies.

Death, Altruism and Sex. As the returns from the questionnaire show in the most emphatic manner, the conception of death does not awaken in the most of cases a very deep individualistic or self-centred consciousness. The centre of the idea of death and its radiations is outside of what is ordinarily called the self, and essentially altruistic. In dwelling on death (Rubric 11), and also in contemplating suicide, it is the feelings of others which are most frequently in the focus of consciousness, although behind this there is of course the motivation of personal feelings. The age of this dwelling is also significant. The first idea of death in the child (Rubric 9) is, as with early man, the death of others. Our instinctive feelings of self-preservation really do not bring in the idea of death at all, but are hereditarily much deeper and more ancient than this peculiarly human

[1] Bastian, *op. cit.*, Bd. II, p. 331.
[2] Bastian, *op. cit.*, Bd. II, p. 331, etc.

conception. We save ourselves first by an uncontrollable reflex and its accompanying or discharging fear. The idea of death and its irradiations come later.

The ideas of primitive folk bear the same character. The ghost is feared to a much greater extent than is the idea of death for self. In most of cases, indeed, death is met quite fearlessly, or at least without the ability to realize its meaning. Stanley tells of offering to buy a negro who was penned up and being fed and otherwise indulged, but who was to be killed and eaten some weeks later. The negro, however, refused to go with him, preferring the present good treatment for a short time to working for his living. When the conception of death is first realized, it is generally not primarily in connection with self as such, but in connection with those reactions, part of ourselves of course, which refer to other people.[1] In many early races, immortality was not conceived possible for the mass of the people, but these believed faithfully in the immortality of their kings and rulers, who of course were those who had impressed them most, and who thus really were the occasion of brain arrangements or their psychical equivalents, which were but slowly side-tracked or irradiated.

The disinclination to quit life seems to be the greatest when the deep altruistic tendencies arising from the sexual life are at their strongest. Tables of suicides show that this crime becomes more frequent at and after the grand climacteric. Old men who still desire to live, are those who have preserved the upper irradiations of the reproductive life in love and sympathy for their fellows.[2] As the late Lord Shaftesbury said of himself, the ceasing of the opportunity to do good for others is the principal motive for fearing death in many old people of the best type. Characters of another kind seem to lose their interest in life with advancing age, and have little reluctance to die.

A deep reference to the sexual and reproductive life pervades much of the ideas of ancient people on this subject. A few cases have already been cited where immortality of one part, at least, meant survival in the race. The Indians of California explain atavism by saying that the soul of the ancestor has come back. Phalli were dried and buried with

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[1] The very idea of self may in some cases be largely made up of extra individualistic reactions, or a conception of self may be regarded as a function of others. The fondness of the epistemologists for pointing out the relativity of these conceptions points in this direction (as a matter of origin).

[2] Cf. author's article on "Sex and Art."

mummies in Egypt. Bastian[1] identifies the Roman Lares and genii. The Lares were originally rude images of male and female organs of generation. The genii were of course disembodied souls. Forlong ("Rivers of Faith") shows the identity of ancestor worship with phallicism in its earliest forms. Ancestor worship, as we have seen, is merged in the belief in ghosts, etc., from which Spencer develops religion. Bodies are frequently buried in the same posture in which the embryo is found in the womb. According to the Susus, the spirit sometimes takes up its abode in a grandchild.[2] Frequently a relative receives the soul. With the Romans the son, or failing him the nearest relative, stood over the body of the dying man to receive his last breath. Many tribes hold the baby of a dying mother over her mouth for the same reason. Celibacy was frequently regarded as a crime in reference to the certainty of death.[3] The first inscription of the Egyptian papyri, perhaps the oldest writing in the world, contains the advice to marry early and have a son.[4] The Greeks buried their youth at night, "for so dreadful a calamity was this (the death of youth) accounted that they thought it indecent and even impious to reveal it in the face of the sun."[5] The three hundred Lacedemonians chosen by Leonidas were all of them fathers with sons living.[6] When "the human plant had flowered," death was not regarded as a shame. This may be compared with the experience of H. B., pp. 90f.

The sexual life, which, as we saw underlies and punctuates the other periods of life, is of very great importance for the last. Not only by the social ties which its proper function calls into being, thus developing the higher sexual radiations of love and sympathy, but on the lower ranges of physiology as well, does the adequate discharge at their proper period of these great hereditary emotions tend to produce a healthy and happy old age. The return of the ghost of the sexual life after it should be properly laid, is even more troublesome and injurious than is the reappearance of our friends or enemies. Here, as well as in the face of the immediate observation of death, is the cathartic rather than the repressive method calculated to produce the best effect. When the sexual functions have been denied or insufficiently radiated

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[1] *Op. cit.*, Bd. II, p. 330.
[2] Bastian, *op. cit.*, p. 331.
[3] Cf. Renouf, "The Religion of Ancient Egypt," p. 148.
[4] Amelineau, "La Morale Egyptienne." Cf. also Ecclesiastes.
[5] Tegg, "The Last Act," p. 32.
[6] Renouf, *op. cit.*, p. 148.

(and their normal gratification is the easiest and most natural condition of their radiation), there is plenty of evidence to show the danger of a recrudescence in old age of the sexual passion in morbid forms of the most unhealthy type.[1] Many senile exhibitionists, perverts, etc., as well as Clouston's[2] old maid's insanity, come under this rubric.

The feeling of guilt, just the obverse of the demand for justice which is such a strong motive in the longing for immortality, is shown nowhere more frequently than in connection with aberrations of the sexual life. The developmental insanity of pubescence connected with failure of the sexual life, is frequently marked by excessive feeling of guilt and often by fear, sometimes of damnation. Many cases of senile dementia also present this character.[3] With the dropping out of the sexual life and with its failure to lay up treasure for itself in the higher regions of the brain, there may thus be either recrudescence of the lower, or complete loss of all the emotions of love, either generative or regenerative, and their substitution by feelings of guilt and fear.

The slighter phenomena of the grand climacteric, the increase of fears, disposition to starts, flushings, burnings, kleptomania, are significant here. When this period is safely passed, however, it often results in a wider, more intellectual, if not a deeper interest in the race. Many have noticed the number of women at this age who fill lecture halls, conduct meetings, and push causes of every kind.

The history of the idea of immortality as contained in phallicism and other ancient religions, bears the strongest evidence as to the connection of the ideas of sex and death.

To conclude, as biologically death and sex come in together, so in the higher psychical life their irradiations are the most closely associated. Sex and reproduction, first a means of overcoming death, sacrifices in doing so the continuity of individual life, but intensifies it by the whole course of evolution. So in the soul-life, love is greater than death, not mystically, but simply as a matter of fact, while the conception of death serves to intensify the psychical life, and give a foil and sense of earnestness[4] to all our enthusiasms. This great background thought has framed not only the deepest love, but also the greatest productions of art, religion and

[1] Schopenhauer went so far as to say that pederasty was allowable for old age.

[2] "Mental Diseases."

[3] A number of cases of this kind were observed by the present writer at the clinics of Dr. Meyer of the Worcester Hospital for the Insane.

[4] Cf. Hawthorne's "The Marble Fawn."

philosophy. God and immortality have risen in obedience to the infinite yearnings with which it stirs the soul. Whatever ontological truth may lie behind these ideas, and that is a question which we have not entered upon here, it remains for us to use these great ideas to the full as the psychological functions which we have attempted to show they are, and to bring thus into the here and now of one life-time the best and highest realization of which it is at present capable. In any case the deep life of love, with the care for offspring, and the natural and spiritual continuity or immortality which they ensure, is the tidal wave upon which all these ideas are upborne, and which, showing itself before maturity and lingering often in its highest radiations into age, in its best function and discharge unites into one whole the different periods of life. The principal danger to be avoided, is hardening into a blind fetichism radiations, which are only vital as they recognize the source from which they spring. In the best conditions, however, these radiations help to harmonize the different periods of life. Youth, maturity, old age, are the sub-major, major and minor chords, of which the eternal dominant note is love.

It is impossible for me to close this paper without acknowledging in the warmest way the continued help and sympathy of Pres. G. Stanley Hall in the prosecution of this study, the subject of which was suggested to me in the course of one of his lectures, while his whole treatment of ancient philosophy and Christianity during the present year has been of the greatest service in its elaboration. To Drs. Hodge, Sanford, Burnham and Chamberlain, I am also much indebted for many kind suggestions concerning the literature in their fields. As to the indispensable coöperation of the many friends who have answered the questionnaire, I have already spoken.

PSYCHOLOGICAL LITERATURE.

I.—NEUROLOGICAL.

Studien über Klinik und Pathologie der Idiotie nebst Untersuchungen über die normale Anatomie der Hirnrinde. CARL HAMMARBERG. Pp. 126, VII plates, 49 figs. K. F. Köhler, Leipzig. (Translated from the Swedish after the author's death by Walter Berger and published by Prof. S. E. Henschen.)

After all the preliminary weighing and measuring, speculating on ventricles and *spiritus animalis*, on *corpora callosa*, pineal bodies and souls, after all the fumbling with "bumps," measuring of lobes and tracing out of convolutions, this research really clinches with the problem of the correlation of mental and cerebral differences. Still all the other work has led up to this, and the researches of Kaes on the comparative medullation of the brain approaches it very closely. Flechsig has shown that in general no tract of fibers begins to function until the sheaths become medullated, so that the number of medullated fibers must be looked upon as an index to the complexity of functioning pathways in the central nervous system. But, important as the medullated fiber is, it arises in the main from a nerve cell, or, speaking more exactly, is only one part of a nerve cell, the most essential part, it may be, from the side of nervous conduction. The fiber arises from and draws for its sustenance upon the cell body. Hence the study which approaches nearest the core and source of all things physical in the brain must deal with the body of the nerve cell, as does this investigation of Hammarberg's.

The author's purpose is practically to compare a series of human brains as to number, size and character of processes of cells, and he must first settle upon a method which will insure reliable results. To this end he examines brains in the fresh state, and compares specimens so obtained with portions of the same brain prepared by various histological methods. Although hardening in alcohol is found to produce a shrinkage of twenty per cent., this seems to be uniform as between different brains, and no further variations occur during the other processes of embedding in paraffine, sectioning and staining. He therefore adopts this method of hardening and sectioning, and stains in methyl blue. Having sections of uniform thickness he next proceeds to count the cells in a 0.1 mm. cube, making this number the basis of his comparison. Here we seek in vain for figures which give exactly the numbers of cells in comparable regions of the brain for the author's entire series. We are told merely that for normal brains for the same areas the counts correspond, and for abnormal brains the method gave constant and comparable results. *(Constante und mit einander völlig vergleichbare Resultate liefert.)*

Hammarberg next passes, in Section II, to the critical description, region by region, of his normal material, consisting of twelve human brains ranging in age from a five months embryo to fifty years. This is prefaced by a discussion of the types of cortical lamination of the authors. He does not in the main subscribe to the usually described types, but says "*im Grossen und Ganzen*" that a motor and sensory type of cortex is fairly indicated. The motor cortex is characterized by the almost complete absence of the fourth layer, its place being usurped, as it were, by the layer of large pyramidal cells. The sensory type is distinguished by a clearly defined fourth layer, with a layer of large pyramids between it and the fifth layer. The author lays no emphasis on even this distinction, final appeal being not to types of arrangement, but to the actual specimens from the different regions of the cortex.

Beginning with the frontal region, the author discusses each important gyrus in a way to cover practically the entire cortex. In his first twelve figures he gives us camera drawings of every cell *in situ* under a magnification of 200 diameters for twelve typical locations in a normal brain. We also have supplied among the figures of normal material single cells of each type drawn in detail under a higher magnification. In the text is stated the exact number of cells in the different layers of each region, and in each figure is given the size of the characteristic cells. The number of cells in a cubic 0.1 mm. is generally from ten to twenty, but may vary from five or six to even as many as ninety.

The third section of the paper consists in a similar analysis of nine defective brains. According to Ziemssen's classification cases I to IV are idiotic (conception and conciousness absent, with impossibility of psychic development). Cases V and VI are low grade imbecile, and VII, VIII and IX are medium to high grade imbeciles. The cases range in age from twenty-two months to twenty-six years. Hammarberg's method of treating a case may best be outlined by following one of the cases through.

Case II, aged fourteen years, hospital record from June 30, 1887, to date of death from acute pneumonia February 28, 1889. Nothing is known as to heredity. Patient has received no wounds, and has never had the usual diseases of children. Idiocy was noticed very early from the fact that the patient showed no signs of attention to anything that went on about her. She never learned to sit or walk or to grasp anything. Then follows a physician's examination of the case, psychological and anthropological as well as medical, made in 1886. The patient is of normal height for her age, but bedridden, and has not the slightest ability to help herself in any way, except to cry when hungry; all traces of speech, recognition of things or persons totally wanting. Each of the cranial nerves is next tested. I, concerning olfactory sensations, nothing is known. II, III, IV, VI give evidence of normal function by movements of the eyes and pupil. V, is functional, as evidenced by sensation in the face region. VII, not paretic. VIII, hearing comparatively acute. IX, nothing is known as to taste. X, XI, XII show no abnormal reactions. Sensibility seems to be normal over the whole body. On the motor side there is paresis of the upper and paralysis of the lower extremities. Reflexes are strong. There are no marked contractures. The muscles of the face and fingers twitch at times and clonic spasms also occur, lasting for a few minutes and being followed by sleep. Condition of patient remains unaltered during the twenty months of hospital life.

From results of autopsy we learn that the dura was adherent, the

sutures of the skull were not closed, the ventricles enlarged and full of fluid, that the brain hardened, weighed 442 grammes, and that the hemispheres were unsymmetrical, the right weighing 138, the left 218 grammes. We are disappointed in not finding data as to size and condition of blood vessels, as to body weight and stature, and as to the fresh weight of the brain. Several pages follow giving the gross anatomy of each region and part of the brain, and five figures showing different views are sufficient to render the explanations clear. Among other things, the insula is lacking or represented by two accessory frontal gyri on the surface, the corpus callosum is membranous and the fornix is defective, a number of important sulci are not represented and considerable areas are unconvoluted. Cerebellum, which is frequently small in such cases, together with the basal ganglia, shows no abnormality. Though the cerebellum is symmetrical, the pons is asymmetrical, following the cerebrum in this respect. The microscopical examination extends likewise to all parts of the brain and is supplemented by several figures in the plates. Instead of the normal number of cells, we find two, three or four, never more than ten, to the cubic 0.1 mm., and the figures show, instead of the large well-developed cells of the normal brain, slender spindles or granules. The cortex consists in several regions of but a single layer of embryonic cells, with no trace of the ordinary differentiation. In other parts it is two layered, a superficial layer of cells partially grown into the pyramidal shape and a deeper layer of simple spindle-shaped cells.

The discussion of each case is closed by an *Epikrise*, in which all the clinical symptoms are balanced in review with all the pathological findings, and a *Diagnose* giving the author's explanations. With this case the total absence of all psychic functions can not be attributed to any or all of the gross findings, microcephalus, asymmetry of hemispheres, absence of corpus callosum, etc. It can be explained only by the condition of the cortical elements. For large areas these have not developed beyond the sixth month of fœtal life; in others they have apparently ceased growing during the eighth month, and only in one limited area, the hippocampal, have the cells assumed the adult form, though even here in point of number and size they fall far below the normal. Up to the sixth month, then, development appears to have been normal, and at this time something occurred, (the author is not able to say what, in this case or in any of his others) which stopped growth in large regions of the cortex and greatly hindered it in the rest. The case is one of arrested development, and in this fact all the sensory, motor and psychic symptoms find their complete explanation.

This will serve as a type both as to character of findings and manner of treatment. In general an arrest of development is diagnosed. In one case, however, active degeneration processes have complicated the usual course of arrest. Several of the imbeciles approach the normal somewhat closely, but in all cases by the author's methods no difficulty is encountered in demonstrating abnormalities in the cortex, in the number, size or type of the cells, and these serve to explain the psychic condition.

In arrangement of matter in the text, the paper leaves much to be desired. No one can read it without feeling that the material has not been utilized to the full, and while the strictly logical arrangement is followed for each case, a logical presentation of the results of the whole group is sadly lacking. No tables are given, and to compare the data of size and number of cells in the different brains, the reader is compelled to hunt through the scattered notes of all

the individual cases. However, these are trivial matters compared with the greatness of the labor and the value of the work. The author died suddenly in the full vigor of opening manhood and in the midst of his great work, one of his last requests being that his work be published in one of the world's great languages. To this sad fact must be attributed the shortcomings in the text.

No such criticism can attach to the plates, most of which bear the legend, "C. Hammarberg del." These certainly constitute one of the great contributions to neurological science. So conscientiously has this work been done that the observer seems to be looking at the very cells of the brains of the normal men and idiots and imbeciles. In one class he sees the rich development of the cortical elements and compares this with the stunted growth in the defectives. Nothing could be clearer and more convincing than this comparison, and nothing could more forcibly present the all important question: What are the causes of the differences observed and what the essential conditions which have favored growth in the one instance and arrested it in the other?

C. F. H.

Contributions to the Structure and Development of the Vertebrate Head. WM. A. LOCY. Journal of Morphology, XI, 497-594, Plates XXVI-XXX, 11 cuts in text, 124 Figs. Boston, 1896.

Since Oken and Goethe first outlined the theory that the vertebrate head represented a number of coalesced and modified vertebræ with their contents and appendages, the subject has attracted attention as one likely to throw some light on the ancestry of the vertebrate phylum. Owen's work was directed largely toward the skull, with the idea that the bones furnished the most trustworthy outlines of segmentation; now these are considered as "external features, of no segmental importance whatsoever." Huxley, with his usual keen insight, turned the discussion toward organs of real segmental importance, the cranial nerves and gill clefts. And again with Balfour's classical work, attention turned toward the mesoblastic somites, of which he clearly identified eight in the region of the head. On the strength of Balfour's work chiefly, the tendency has prevailed among embryologists to consider the mesoblastic segments the primary divisions to which the nervous axis has come secondarily to conform. This is the view quite generally expressed in the various vertebrate embryologies. Thus the nervous system is moulded by its environment mechanically, as it were, and at the outset must therefore waive its claim to being the "master organ" of the body. It is thus seen to be of considerable psychological and physiological importance that Locy brings out the fact that the first traces of segmentation appear in the neural plate and not in the mesoblast, and thus the nervous system assumes its position from the first.

In three former papers (reviewed in this JOURNAL, VI, 448), Locy states the main fact, viz., that he finds eleven neural segments clearly outlined in the expanded portion of the neural plate in one of the sharks, in *Amblystoma Diemyctylus* and in *Torpedo ocellata*. The present paper marshals all the facts which the author has been able to gather, and presents them in the clearest possible form, and lavishly illustrated. The chick and frog are also found to have the same number of head segments, though very obscure in the frog. In the chick they may be observed as soon as the neural folds are formed, and for some time after the mesoblastic somites begin to develop. That they are not artefacts is witnessed by the

fact that they are uniformly found in material after different methods of preservation, and especially by the fact that the segments can be seen in the fresh living embryos.

The entire number of segments in the brain region is given as fourteen, with a possible fifteenth represented in the median unpaired tip at the extreme front. Between these primitive segments and the cranial nerves the relations are not definitely ascertainable at present. A "tentative estimate of numerical relations" is as follows: I. First neuromere of fore-brain, olfactory. II. Second neuromere of fore-brain, optic. III. Third neuromere of fore-brain, possibly nerve to pineal sense-organ. IV. First neuromere of mid-brain, oculomotor. V. Second neuromere of mid-brain, trochlearis. VI. First neuromere of hind-brain, anterior root of trigeminus. VII. Second neuromere of hind-brain, main root of trigeminus. VIII. Third neuromere of hind-brain, no nerve root, in early stages. IX. Facialis. X. Auditory. XI. Glossopharyngeal. XII, XIII, XIV. Roots of vagus.

A summary of nine headings closes the first part of the paper. Abbreviated these are as follows: 1. The neuromeres are not artefacts. 2. "Neuromeric segmentation" appears "long before there are any segmental divisions of the mesoderm," and is therefore "more primitive than mesodermic segmentation." 3. The structure of the segments proves them to be characteristic cell groups and not mere "mechanical undulations." 4. The entire embryo is similarly segmented, passing thus through an arthrometric condition similar to that of arthropods and worms. 5. Eleven segments are clearly defined in front of the vagus region, or fourteen in all (nine in the hind-brain, two in the mid-brain and three in the fore-brain). 6. There is evidence to show that the spinal cord is being encroached upon by the brain, seven segments appearing first in the hind-brain, two more differentiating later. 7. The segmentation is clearest in the epiblast and least clear in the mesoblast. 8. The segments are related to cranial and spinal nerves and sense organs. 9. The neuromeres are greatly modified and early obliterated in front, persist until after the development of the cranial nerves in the hind-brain region, and then they fade away.

The second part of the paper is devoted to a discussion of the sense organs, by which the author's former position is strengthened. It is especially useful as a presentation of the evidence which indicates that the sense organs of the head region arise in a serially homologous manner, from the nasal pits and optic vesicles to the auditory and lateral line organs.

C. F. H.

Notes of a Case of Dual Brain Action. LEWIS C. BRUCE. Brain, LXIX, 1895, pp. 54-65.

The peculiar interest attaching to this case relates to the definite evidence presented to prove that the right and left cerebral hemispheres controlled the individual in different and characteristic ways. The subject is a Welsh sailor, insane fifteen years, noted for exhibiting two distinct states. These the author distinguishes briefly as the "English" and "Welsh" state. In the Welsh state he was "absolutely demented," and did not understand a word that was said to him, but frequently jabbered incoherent Welsh. From this state he passed quite suddenly into the English state, in which "he was restless, talkative, destructive and mischievous," and expresses himself in English, and understands what is said to him. In the Welsh state he "used the left hand exclusively" and

wrote "mirror script;" in the English state he was right-handed, and wrote from left to right in the ordinary way. In passing from one to the other he was often ambidextrous and spoke both Welsh and English. In the English state he is fairly intelligent, draws pictures of ships and tells stories of his former life. His memory is a complete blank for all events that have occurred to him during the Welsh state, while he remembers clearly things that happened during previous English states. The right and left-handedness make this one of the clearest cases of dual brain action on record. The pulse was different in the two states, full with high tension in the English, and weak with lower tension during the Welsh state.

C. F. H.

Mental Stupor as a Pathological Entity. JAMES R. WHITWELL. Brain, LXIX, 1895. Pp. 67-73.

The author's observations on a group of cases in which "mental and nervous lethargy and torpor," . . . . and "no sign of originating mental power" are characteristic features, tend to support the theory that the condition is caused by deficient development of the vascular system. He finds in general a disproportionately small heart or aorta or basal cerebral vessels, one or all three, which suggests that the vascular system has "ceased developing at the stage of evolution or about puberty or adolescence." Either this lack of proportion between vascular and cerebral systems is present or the stupor is intermittent, "caused by or associated with temporary spasm of the peripheral vessels during the period of mental stupor, this spasm relaxing during the period of lucidity." In the general thesis this line of reasoning resembles a theory now practically abandoned, viz., that early anchylosis of the skull sutures prevents development of the brain.

C. F. H.

On the Accelerator and Inhibitory Nerves to the Crab's Heart. F. S. CONANT and H. L. CLARK. Journal of Experimental Medicine, Vol. I, pp. 340-46. Baltimore, 1896.

It is somewhat surprising to find the nervous control of the heart in crustacea practically as complete as in the vertebrates. The crab experimented upon was the common edible crab, *Callinectes hastatus*, and, while others have demonstrated accelerator and inhibitory effects on the stimulation of various nerves in the crustacean, the exact anatomical relations, together with the physiological function of each nerve, have not been clearly made out by previous observers. All the cardiac nerves arise from the anterior part of the thoracic ganglion. The most anterior pair of heart nerves are inhibitory. Behind these, opposite the origin of the nerves to the third maxillipeds and first ambulatory leg, arise two pairs of accelerator nerves. Besides these, as in the higher animals, a ganglionic plexus is present in the pericardial wall. This nervous supply is able, with the heart isolated, to carry on the rhythmical beat normally, as in higher vertebrates. Stimulation of the cerebral ganglia invariably caused inhibition. Actual tracings were obtained by delicate tambours, which give the main results with graphic clearness.

C. F. H.

A Case of Circumscribed Unilateral and Elective Sensory Paralysis. LEWELLYN F. BAKER. Journal of Experimental Medicine, Vol. I, pp. 348-60.

Owing probably to a cervical rib pressing upon some of the posterior fibres of the brachial plexus, cutaneous sensibility is deficient

over the area of distribution of the median brachial and antibrachial nerves of the author's left arm. A most thorough survey of this region by the methods and under the direction of Professor v. Frey shows that "in this area the sensations for warmth, cold, pressure and touch are absent." There is also a slight diminution in the number of pain spots. It is of especial interest to note that tickle is also absent from the affected region.

A Comparative Study of the Point of Acute Vision in the Vertebrates. J. R. SLONAKER. American Naturalist, Jan. 1st, 1896. Pp. 24-32, 4 Figs. in text.

A first step in any adequate comparative psychology must be a knowledge of animal sense organs. This has been secured recently by Tuckerman for organs of taste in vertebrates, but the discovery of sense organs so closely resembling taste buds by Langdon over the surface of the earth-worm must open up the subject again, and bring the realization that a wide region of terra incognita as to these structures exists in the invertebrates, and the recent investigations of Retzius renders it clear that to search the tongue and mouth cavity is not sufficient even for the vertebrates. The great work of Retzius stands as a classic for the ear and the most fruitful physiological studies have followed it. With the eye our knowledge has remained deficient, touching exactly the area of clearest vision, and this is just the point which should give us our first generalization, from what we know of human vision, as to the character of vision in the lower animals.

Mr. Slonaker's complete paper, soon to be published, of which the above is a partial abstract, gives the results of his examination of ninety-three different species, of which eighteen are mammals, forty-one birds, six reptiles, three amphibians and twenty-five fishes. In addition to the forms actually examined, the author has sifted the literature to date, and presents his results with those of other observers in convenient tabular form. The table gives species of animal, character of area and fovea and name of observer. Following this long table is a condensed statement, which will serve to give at a glance a notion of what part of the field has been covered.

No. of Species.	Number Areas Found.	Number Foveas Found.	Area.			Fovea.		
			One Circular.	Two Circular.	Band-like.	One Simple.	Two Simple.	Trough-like.
48 Mammals	10	38	28		8	15		
102 Birds	0	1	59	11	36	72	11	22
25 Reptiles	3?	17	20		3	6		2
13 Amphibians	3	11	3		7	2		
30 Fishes	10	25	20			5		

From the above we see that in mammals possession of a visual area of band-like or circular from is the rule. A farther differentiation

to a fovea occurs only in the primates. Birds are provided generally with a circular area with a foveal pit developed in its centre. As birds' eyes are placed laterally and the fovea is in the optical axis, it can serve only for monocular vision. A considerable number of birds, however, possess much more complicated mechanisms for clear vision. Besides the central area and fovea, many birds, notably, swallows, terns, hawks and others, are provided with two foveas, situated in their corresponding areas, one central for monocular vision, and one situated, in species having a lateral position of the eyes, as the swallow, close to the ora serrata on the temporal side. This arrangement probably renders parallel binocular vision possible with the eyes at rest, and in convergence gives the bird a binocular view of near objects. It is further shown that as the eyes approach the frontal position, as seen in the hawks, the temporal fovea comes to be placed relatively near the central, and when the frontal position is practically attained, as in the owl, we find a single central fovea serving for both binocular and monocular vision, as in man and the primates.

Following the tables the author gives a brief statement concerning each species examined, beginning with the mammals and going down the vertebrate series. In some cases his results differ from other observers, a notable case of difference occurring with reference to the "trough-like" fovea described and figured by Chevitz for several birds. Slonaker finds a dark line passing through the centre of certain band-like areas, giving somewhat the appearance of a trough in surface views. Sections across the area, however, in every instance reveal no trace of a depression. He is, therefore, warranted in questioning, for the present, the existence of a trough-like foveal depression.

The closing portion of the article is devoted to an outline on the physiological side of the character of vision as correllated with the retinal mechanism possessed by the animal. The writer's anatomical studies up to this point have led up to this subject, but have not afforded time as yet for its adequate investigation. The main generalization as to the character of foveal and retinal vision is borne out, viz., that for the perception of objects in motion an undifferentiated retina or slightly differentiated area is sufficient, and that when an animal's life comes to depend upon its ability to see clearly motionless objects, a fovea is developed.

C. F. H.

Die Alkoholfrage und ihre Bedeutung für Volkswohl und Volksgesundheit. Eine sozial-medizinische Studie für Aerzte und gebildete Laien. Von DR. AUGUST SMITH. Tübingen, 1895, pp. iv, 127; plates, 7.

As a result of a series of experiments suggested by Professor Kraepelin to test the influence of alcohol upon psychical processes, Dr. Smith, byadministering forty to eighty grammes of alcohol daily in small doses, obtained in his subjects a gradual decrease in ability to add, amounting in twelve days to about twenty per cent., while for memorizing, a final diminution of about seventy per cent. was observed after the same time. Cessation of the use of alcohol was accompanied by the immediate return to the normal, followed by an evidence of improvement due to practice. The return to alcohol after seven days gave an immediate and marked decrease.

In another research, associations were recorded and arranged according to Wundt's classification as inner, outer and "*sinnlich zusammenhanglose.*" The charted results show a marked percent-

age of increase of those of the second and third classes and a decrease in the occurrence of those of the first on days when alcohol (40-80 grammes) was administered, with the reverse on normal days. The book is an addition to an already long list of compilations and restatements of previously advanced arguments, sociological, ethical, psycological, physiological and pathological, against the use of alcohol. Special sections are devoted to statistics of mortality and disease, the symptoms and conditions of chronic alcoholism, and the consideration of prophylactic measures.

C. C. STEWART.

Experimentelle Untersuchungen über die Veränderungen der ganglienzellen bei der acuten Alcoholvergiftung. Von DR. MED. HEINRICH DEHIO. Centralbl. f. Nervenheilkunde und Psychiatrie. März-Heft, 1895.

In undertaking the experimental study of changes in nervous cells, Dehio has chosen alcohol because of our more or less complete knowledge of its psychological and clinical effects. Eight rabbits, of which two were controls and one, being diseased, was useless, formed the first series for experiment. Alcohol was administered by mouth and by sub-cutaneous injection, the latter method producing the greatest results in the shortest time. The usual dose was 7 to 10 c.c. of 96% alcohol reduced to 40%, followed, as consciousness returned, by a further dose of 5 c.c., until in all 20 or 25 c.c. had been given. Death occurred in from one hour to thirty-four hours, according to the amount of alcohol administered.

Slides were prepared by Nissl's methyl-blue method (nitric acid and Flemming not giving any reliable results). The effect of the alcohol poisoning was not observed with any certainty in those animals which died in the earlier stages of intoxication, and in the others was most easily demonstrable in Purkinje's cells of the cerebellum. The observed pathological changes in the cells are described for them alone. The fine-meshed network of the blue staining substance is replaced by fine, irregularly arranged granules of more or less constant size. The achromatin is colored faintly blue. Sometimes the whole cell, sometimes only a part, is affected. Nucleus, nucleolus and cell processes are unchanged. By no means all the cells are affected, often only a relatively small number.

Another series included three dogs: one control, one living five hours, and the third thirty hours. The one living five hours showed nothing, while the one intoxicated for thirty hours gave more pronounced results than the rabbits.

C. C. STEWART.

II. ANTHROPOLOGICAL PSYCHOLOGY.

BY ALEX. F. CHAMBERLAIN, PH. D.

Die Denkschöpfung umgebender Welt aus kosmogonischen Vorstellungen in Cultur und Uncultur. A. BASTIAN. Berlin, 1896, 211 S. 8vo.

Another study in folk-psychology from the *doyen* of German ethnologists. This is a typical volume of Bastian's, and exhibits at once his merits and defects. It is a wilderness of facts, with imperfect references, and no index of tribes and peoples noticed. For all that, however, the book is an invaluable one to the psychologist and the student of the mind of primitive peoples.

Die Anfänge der Kunst. E. GROSSE. Leipzig, 1894, vii, 301 S. 8vo.

This volume of Dr. Grosse is a most welcome addition to the literature of primitive art. The eleven chapters are as follows: The object of the science of art; its way; primitive peoples; art; cosmetics; ornament; sculpture; the dance; poetry; music; conclusion. The author shows a firm grasp of the subject, and refers to important recent essays and studies of the art of the lower races of men. Dr. Grosse's general conclusion is worth quoting in his own words: "But the correspondence of the artistic creation of the rudest peoples and that of the most cultivated does not extend to breadth alone, but to depth also. However heterogeneous and inartistic the primitive art forms sometimes appear at first sight, yet so soon as we examine them more closely, we always discover that they are fashioned after the same laws which govern the highest creations of art. . . . In consideration of this fundamental correspondence, the differences between primitive and the higher art forms seem to be more of a quantitative than of a qualitative kind. The *Gefuhle* of primitive art are narrower and ruder, its forms are poorer and clumsier, but, in its essential motives, means and ends, the art of primitive times is one with the art of all times."

An Ethnologist's View of History. An Address before the Annual Meeting of the New Jersey Historical Society, Trenton, N. J., Jan. 28, 1896. By D. G. BRINTON. Philadelphia, 1896, 24 pp. 8vo.

In this interesting paper the foremost of America's anthropological philosophers sets forth his objections to the current views of the philosophy of history, and argues for a higher and better interpretation based upon the teachings of ethnology. His chief conclusions are: Men do not live in material things, but in mental states; and solely as they affect these are the material things valuable or valueless. The chief impulses of nations and peoples are abstract ideas and ideals, unreal and unrealizable; and it is in the pursuit of these that the great as well as the small movements on the arena of national life and on the stage of history have taken place. *The conscious and deliberate pursuit of ideal aims is the highest causality in human history.* Man can be explained only by man, and can be so explained perfectly. Requisite to the comprehension of ethnic psychology, and, therefore, desirable to the ethnologist and the historian, are the poetic instinct and nobility of personal character.

Seven Venerable Ghosts. J. W. POWELL. Amer. Anthrop., Vol. IX (1896), pp. 67-91.

The "seven venerable ghosts" discussed by Major Powell are *matter, essence, space, force, time, spirit, cause.* To use his own words: "These are the seven ghosts of science: the ghost of substance, the ghost of essence, the ghost of space, the ghost of force, the ghost of mind, the ghost of time, the ghost of cause, — seven reified words, seven voids, seven nothings." The paper is written in Major Powell's well-known incisive style.

The Animistic Vampire in New England. GEO. R. STETSON. Amer. Anthrop. (Washington), Vol. IX (1896), pp. 1-13.

From this article, which résumés the vampire superstition, we learn that in New England "it is believed that consumption is not a physical, but a spiritual disease, obsession or visitation; that as long as the body of a dead consumptive relative has blood in its heart, it is proof that an occult influence steals from it for death,

and is at work drawing the blood of the living into the heart of the dead, and causing his rapid decline."

A Vigil of the Gods—a Navaho Ceremony. WASHINGTON MATTHEWS. Ibid., pp. 50-57.

A description by a most competent observer of "rites occurring on the fourth night of a great nine-days' ceremony, known among the Navaho as *kiedji hathal*, or the night-chant." The following observation of the author is worth noting: "This ceremony, like nearly all other ceremonies, ancient and modern, is connected with a legend or myth (several myths, indeed, in this case), and many of the acts in the ceremony are illustrative of the mythic events."

The Growth of Indian Mythologies. F. BOAS. Journal of American Folk-Lore, Vol. IX (1896), pp. 1-11.

In this essay the author outlines his theory of the growth of Indian mythologies as based upon studies of the traditions and tales of the Indian of the North Pacific coast of America. Dr. Boas' general conclusion is that "similarities of culture on our continent are always more likely to be due to diffusion than to independent development." Touching myths, he observes: "Perhaps the objection might be raised to my argument that the similarities of mythologies are not only due to borrowing, but also to the fact that, under similar conditions which prevail in a limited area, the human mind creates similar products. While there is a certain truth in this argument, so far as elementary forms of human thought are concerned, it seems quite incredible that the same complex theory should originate twice in a limited territory. The very complexity of the tales, and their gradual dwindling down, to which I have referred before, cannot possibly be explained by any other method than by dissemination."

Indianische Sagen von der Nord-Pacifischen Küste Amerikas. Sonder-Abdruck aus den Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte. Berlin, 1895, VI, 363 S. 8vo.

This volume contains tales and legends from some twenty-five tribes and peoples of British Columbia and Alaska, together with a chapter on the "Development of the mythologies of the North Pacific coast." The German texts of the myths alone are given, but here and there explanatory notes are intercalated. The book contains a mass of material to be worked over by the psychologist and philosophic anthropologist. It is the only work of its kind on the mythology of the northwest coast.

Australian Rock-Pictures. R. H. MATTHEWS. Amer. Anthrop., Vol. VIII (1895), pp. 268-278.

Australian Ground and Tree Drawings. Ibid., Vol. IX (1896), pp. 33-49.

These two papers, together with other publications of the author in the Proceedings of the Royal Society of Victoria and the Royal Geographical Society of Australia, résumé all that is known concerning the subject of Australian aboriginal drawings, and the figures accompanying the text, with the careful descriptions, make these contributions valuable for comparison with the art of children, to which so much attention has of late been given. Of a certain group of cave-pictures the author says: "Interspersed among

the other figures, and, in some instances, partially covered by them, are seven human hands, done in white in the 'stencil method' of drawing. The only right hand among these is shown in the shut position, which is rather uncommon" (p. 271).

The Beginning of Agriculture. W. J. McGEE. Ibid., pp. 350-375.

Under the heads of regional characteristics, vegetable life, animal life, coöperative characteristics of life, human life, etc., Prof. McGee treats of that little known region in Arizona and Sonora (Mexico) called by the Spaniards "Papagueria," or country of the Papago Indians. It is a careful study of the influence of environment. The author's general conclusion is as follows: "It may appear paradoxical to affirm that it is in arid districts, where agriculture is most arduous, that agriculture began; yet the affirmation is not gainsaid by history, and is established beyond reasonable doubt by the evidence of the desert organisms and organizations. So, whatever its last estate, in its beginning, agriculture is the art of the desert."

Introduction of the Iron Age into America. O. T. MASON. Ibid., Vol. IX (1896), pp. 191-215.

Among the topics touched upon in this graphic sketch are: Absence of siderotechny from America, varieties of acculturation, intrusion of African culture, intrusion of Aryan culture, Eskimo and the Iron Age, the Iron Age and the Indians, the Russian Iron Age, the Iron Age on the Pacific coast, the Mediterranean Iron Age. The author's chief conclusions are: (1) Aboriginally there was neither smelting of iron nor working by means of it in America, —no iron products, no use of iron as a metal. (2) The Iron Age that modified America was the conservative folk-age, the Middle Age as distinguished from the Renaissance, which replaced the old in progressive Europe.

Mediæval "Glamour" and its Antidotes. DAVID MACRITCHIE. Amer. Antiq., Vol. XVIII (1896), pp. 87-95.

The conclusion of the author is that "*glamours*" are the mediæval equivalent of "mesmerism," and that this theory "places many of the folk-tale incidents in a new light."

Devil Worship as an Early and Natural Stage in the Evolution of Religion. DR. PAUL CARUS. Ibid., pp. 95-98.

The most interesting point in this essay is the interpretation of Leviticus xvi, where *Azazel* ("the strength of God"), translated "scape-goat" in the King James' Version of the Bible, is regarded as "a last remnant of a prior dualism" — Azazel, the strong god, has become a mere shadow of himself.

The Work of the Kunger-Bag. ALEX. W. BEALER. Ibid., pp. 99-106.

This is an interesting contribution to the literature of "conjuring" among the negroes of the south. The bag and its contents are fully described.

The Negro in the West Indies. F. L. HOFFMAN. Publ. Amer. Statist. Assoc. (Boston), Vol. IV (1895), pp. 181-200.

This study, well furnished with statistical tables, treats of population, elements of population, birth and death rates, conjugal condition, education. The following remark of the author is note-

worthy: "The statistics of conjugal condition, previously given in this paper, prove that the prevailing moral condition of the colored population of these islands is worse to-day than it could possibly have been in the past, and that, with the exception of the Bermudas, the tendency does not seem to be upward, but toward a still lower level of immorality and vice."

Left-Handedness in North American Aboriginal Art. D. G. BRINTON. Ibid., pp. 175-181.

This paper gives the results of the examination as to "plane of cleavage," asymmetry, etc., of several hundred flint blades in the museum of the University of Pennsylvania, taken from different parts of the United States. Dr. Brinton concludes: "The hand preferred was no doubt the right hand, but the notably large proportion of thirty-three per cent. for probably left-handed work indicates either that there were more left-handed persons, or, as I prefer to believe, that there were more who were ambidextrous. This may have been due to the fact that the methods of flint-chipping favored the use of both hands, but it is as likely that it indicates a general physiological tendency." From the observation and examination of drawings and picture-writing of the Indians, the author arrives also at the result that "the aboriginal race of North America was either left-handed or ambidextrous to a greater degree than the peoples of modern Europe." The real source of the preference for the right hand, which (though not to the same degree) has existed in the majority of mankind from earliest times, Dr. Brinton holds, lies in *the erect posture of the human species.*

Ueber die Vererbung erworbener Eigenschaften. G. RETZIUS. Biolog. Untersuch., Neue Folge, VII (1895), S. 61-71.

After brief discussion of previous literature on the subject, the author résumés the results of the investigations of Prof. Havelock Charles of the medical school in Lahore, India, on the "Influence of Function as Exemplified in the Morphology of the Lower Extremity of the Panjabi," a paper published in the *Journal of Anatomy and Physiology* for 1893, and another paper on "Morphological Peculiarities in the Panjabi and their Bearing on the Question of the Transmission of Acquired Characters," in the same periodical for 1894. Not only does Prof. Retzius see in these data evidence of the origin of variation through difference in body-position, customs and uses, but also of the possibility of the hereditary transmission of such peculiarities. The retroversion of the tibia is one of the most noticeable of these. According to Retzius this is also a *constant* characteristic of the Swedish fœtus; indeed, perhaps of the fœtus in general, and in it we have "*an original morphological character,*" transmitted from grey antiquity by inheritance. But we must be careful not to mistake something else for an atavistic or hereditarily transmitted acquired characteristic. The ethnological side of the subject is still somewhat dark.

The Arrow. F. H. CUSHING. Amer. Anthrop., Vol. VIII (1895), pp. 307-349.

This is the first part of a most valuable and detailed study of the antiquity of the arrow, its influence, its relation to anthropology, the typical arrow, arrow-making, the origin of early art and of lance-form tools, the development of arrow-form missiles, the origin of the dart-flinger and the bow, — in brief, the complete history of the arrow as only an expert, like Mr. Cushing, could give it.

There is a good deal of truth in the author's remark that "as it was the chief reliance and resource of primitive man in the two main activities of his life—war and the chase,—it speedily became his first, and ever remained, by representation at least, his highest, instrumentality for divining the fate or fortune its use so often decided, and in this way came to affect, as no other single object of art ever did, the development and history of mankind in general the wide world over."

Korean Games, with Notes on the Corresponding Games of China and Japan. S. CULIN. Philadelphia, 1895, 177 pp. 4to.

This volume naturally belongs with Mr. Cushing's study of the arrow. Its chief original feature is a masterly attempt to trace back all games of divination to the arrow — cards, dice, chess, etc., all belong there. The special portion of the work is treated with remarkable skill, the introduction is scholarly and philosophical, and in every respect this volume is worthy of high rank. Korea is here made to serve the whole world. The volume is well provided with plates, figures, and index, well printed and well bound.

An Iroquois Condoling Council. A Study of Aboriginal American Society and Government. HALE. Trans. Roy. Soc. Can., Sec. Series, 1895-6, Vol. I, Sect. II, pp. 45-65.

In this paper Mr. Hale describes the most important and rarest of the public ceremonies and festivals of the Iroquois Indians of Canada, "the Condoling Council," at which he was present in July, 1883. The distinguished author does not hesitate to pay marked tribute to the intellectual and moral qualities of the Iroquois, "a people whose achievements, institutions and language show them to have been, in natural capacity and the higher elements of character, not inferior to any race of men of whom history preserves a record."

Durée de la Génération Humaine. Fécundité comparée de l'homme et de la femme suivant l'âge. M. V. TURQUAN. Revue Scientifique, 4e Série, Tome V (1896), pp. 8-17, 167-176.

This valuable demographic study is accompanied by numerous maps, tables and curves, with great detail of subdivision. The author's general conclusions are that at the age 15–19 years the fecundity of French women is hardly inferior to that of other Europeans, but beginning with the twentieth year the fecundity falls, and up to the thirty-fourth year is hardly two-thirds that of the Europeans, and after the thirty-fifth year one-half. In general, the natality in France is to the natality of other European countries as two is to three, but the mortality is nearly a third larger.

La Famille Annamite. PAUL D'ENJOY. Ibid., pp. 243-244.

In Annam "the ancestor represents divine right, and the family, like the state, is an absolute monarchy, whose privileges are based on birth."

Les Formes Primitives du Travail. G. FERRERO. Ibid., pp. 331-335.

The author is scarcely correct in asserting that "idleness and savagery are synonymous," and Robertson is not the best authority on the general characters of the American aborigines. Nevertheless the author's views are interesting and to some extent well supported. His chief points are: (1) The productive labor of civilized man is regular and methodic—savage *sport* is irregular

and intermittent; (2) in productive labor the excitation is voluntary, while in savage *sport* it is almost automatic; (3) in savage *sport* there is a voluptuous element which is lacking in productive labor, being replaced by an element of pain; (4) modern *sports*, in all their forms,—bicycling, horse-riding, Alpinism, etc., are identical with the first forms of savage activity.

La Sénsibilité de la Femme. M. OTTOLENGHI. Ibid., pp. 395-398.

This article résumés experiments on 400 men and 681 women. The author concludes that it is certain that women feel pain less acutely than men, and that suggestion and auto-suggestion (emotion, example, imitation) influence much the sensitiveness of women to pain. This less sensibility to pain he regards as a characteristic of inferiority.

La Notation des Couleurs au Japon. M. A. ARRIVET. Ibid., pp. 653-656.

This is a valuable study of Japanese color-names.

Racial Anatomical Peculiarities. D. K. SHUTE. Amer. Anthrop., Vol. IX (1896), pp. 123-132.

Dr. Shute concludes that "some of the anatomical peculiarities, which, taken together, stamp a race as high or low," are the following: "Cranial sutures that are simple in arrangement and unite early; a wide nasal aperture, with the nasal bones anchylosed; undue projection of the jaws and receding chin; well developed wisdom teeth appearing early and permanent; a humerus of undue length, and perforated; an elongated calcaneum; a small calf of the leg; a flattened tibia; a narrow pelvis, etc. These characters, the author thinks, are "simioid," and the races which possess them "in largest number and development" are "lowest in the scale." Dr. Frank Baker, in the discussion on Dr. Shute's paper, took occasion to call attention to the abuse of the term "atavism" by biologists and to the misunderstanding of what are called the racial peculiarities of the negro," and remarked that "there does not seem to be adequate ground for the conclusion that his racial peculiarities are remarkably simian;" also "after examination of many bodies of Africans found in the dissecting rooms, it seems evident that ape-like characters are no more common among them than among whites." Dr. Th. Gill thought that the key-words for the explanations of these peculiarities in great part were *use* and *disuse*.

The Purposes of Ethno-Botany. J. W. HARSHBERGER. Amer. Antiq., Vol. XVIII (1896), pp. 73-81.

This article is a plea for an ethno-botanical garden "to surround the museum building, to provide living plants for study in connection with the objects of vegetal origin displayed in the museum." The idea is to "arrange the plants with reference to the Indian tribes who cultivated them," and it is hoped that such a garden would soon "become a Mecca for those who desire to write upon our American plants and their uses among the aborigines."

A Contribution to Ethno-Botany. J. W. FEWKES. Amer. Anthrop., Vol. IX (1896), pp. 14-21.

This is a study of plants used for food and medicinal purposes by the Tusayan Indians, with etymological explanations of the names, where interpretation is possible. Of the *Mentzelia albicaulis*, it is interesting to learn that "its seeds are gathered by the girls in the afternoon, as it is asserted that the seeds will not fall until the sun has passed half way over the sky."

Beitrag zur Pflanzenkunde der Naturvölker America's. A. F. CHAMBERLAIN. Verh. d. Berl. Anthrop. Ges., 1895, pp. 551-556.

A study of plants used as food and medicine by the Kootenay Indians, with etymological interpretations where possible.

The Food of Certain American Indians and the Methods of Preparing it. L. CARR. Proc. Am. Antiq. Soc. (1894), Vol. X (Worcester, 1895), pp. 155-190.

A valuable contribution to the study of food among primitive peoples, a subject of increasing importance in ethnology.

The Whip-poor-will as Named in American Languages. A. S. GATSCHET. Amer. Antiq., Vol. XVIII (1896), pp. 39-42.

In this brief but valuable article Dr. Gatschet presents a rare onomatological study of interest to the students of the psychology of language, especially of onomatopœia. Names of the bird are given from Algonkian, Iroquoian, Maskoki, Yuchi, Natchez, Siouan, Sahaptian and Zuñi languages and dialects, and, whenever possible, etymologies are given. It is worth noting that among the Kayowé there is a children's name for the whip-poor-will, *pābī* = "younger brother."

The Mystery of the Name Pamunkey. W. W. TOOKER. Ibid., Vol. XVII (1895), pp. 289-293.

In this paper Mr. Tooker skillfully interprets for us the name *Pamunkey*, now designating a small tribe of Indians and a river of Virginia, but also in reality "a survival to our times of one of the reminders of an esoteric system which existed among the Powhatan tribes of Virginia at the commencement of the seventeenth century."

The Algonquian Appellatives of the Siouan Tribes of Virginia. W. W. TOOKER. Amer. Anthrop., Vol. VIII (1895), pp. 376-392.

Mr. Tooker treats with his accustomed *Sprachgefühl* and keen analysis the names which came to be given to the Siouan tribes of Virginia from the speech of another and distinct linguistic stock, with whom they came more or less into contact. Like others of Mr. Tooker's papers, this one also is a most welcome addition to the literature of the psychologyof primitive languages.

III. MISCELLANEOUS.

Das Wesen des Humors. Von DR. JOSEPH MÜLLER. München, 1896.

Humor, the most complicated form of æsthetical perception, is, according to Müller, still an unsolved problem. It is not strange, when one considers the quality of the theories hitherto propounded. One reads with weariness, not unmixed with pity, metaphysical and "idealistic" theories of humor in which the finite and the infinite, the ideal and the divine, the sensual and the non-temporal, etc., are held to be constituent elements of all humor. It is too Ptolemaic, too theocentric, too adulto- or anthropo-centric, if I may use such terms. An inductive study based on animal, children, youth, old age and the insane is needed and will doubtless soon appear.

Dr. Müller cites the various theories, all "made in Germany;" he has never heard of Herbert Spencer's view, and knows nothing of "barbarians" in general. Of the authors cited, Jean Paul makes humor to be the application of the finite to the infinite,

whereas its opposite, the sublime, is the application of the infinite to the finite. "Humor annihilates not the individual, but the finite through the contrast with the Idea." Vischer makes humor to be *Selbstverlachung*, and adopts Jean Paul's theory in general. "*Der Humor treibt immer Metaphysik.*" Ruge speaks of a "*Begnadigung der Welt durch Liebe*," and Lorms of a groundless optimism. Solger says that humor seeks in the most temporal and the most sensual the whole power and meaning of the divine, and Müller approves of the dictum. Lazarus speaks of the "*potenzirtes Nichtige*" in humor and makes it a conflict between the understanding and the feelings. Müller himself adds little or nothing to the better comprehension of the subject. ARTHUR ALLIN.

Notice sur le Laboratoire de Psychologie de l'Université de Genève. Par Prof. TH. FLOURNOY. Genève, Librairie Ch. Eggemann & Cie., 1896.

This pamphlet is an elaboration of the notice written for the *Histoire de l'Université de Genève*, published under the auspices of *Société Académique* and the University Senate in connection with the National Swiss Exposition in 1896. It contains a brief history of the psychological laboratory at Geneva since its inception in 1891, a statement of its present resources as to equipment, books, periodicals, etc., including a full list of apparatus, a list of the publications already issued by the laboratory, and an epilogue containing arguments in justification of founding a special chair of experimental psychology at Geneva and its future possibilities in coördination with the other sciences. The record of the Geneva Laboratory under Prof. Flournoy's charge has been most creditable.
THEODATE L. SMITH.

Observations sur Quelques Types de Réaction Simple. Par TH. FLOURNOY. Genève, Librairie Ch. Eggemann & Cie., 1896.

This contribution to the psychology of reaction time, a pamphlet of forty-two pages, is a report of studies made in the Geneva Laboratory during the years 1892-96. The author does not enter into the controversy between the adherents of Lange's theory and the Leipzig school, represented in this country by Profs. Baldwin and Titchener, but proposes to indicate the various individual types of reaction which have been brought out with more or less clearness by the reaction measurements in the Geneva Laboratory. In the course of four years Prof. Flournoy has accumulated some 25,000 reaction times, taken upon seventy students of both sexes, and ranging from 2,000 to not less than fifty for one individual. The d'Arsonval chronometer, for which a great advantage in saving of time is claimed, was used in preference to the Hipp chronoscope for the majority of these measurements. The principal aim of the research was to observe the *influence and direction of attention* upon the quickness of reaction times, and the time measurements were taken in the form of comparative series, where this factor alone is varied, all other circumstances remaining the same. Two successive groups of twelve reactions each, executed under the guidance of a certain mental orientation, *i. e.*, sensorial, visual or motor attention, adopted by the subject at the beginning of each series, were taken, the groups being alternated to eliminate the slight effect of fatigue. The two groups were separated by an interval of a few seconds in order to allow the readjustment of attention by the subject. Only simple reactions were used, no reactions with choice being included in the report. Apart from mixed cases, the author finds among his subjects four distinct types, which he clas-

sifies under the following heads: 1. Motor type, including the natural motor type and the artificial motor type, *le type moteur forcé*. 2. The central type. 3. The indifferent type. 4. The sensorial type, subdivided into visual-motor (*visuomoteur*) and kinæsthetic-motor (*kinésomoteur*).

The term central attention is adopted from Dr. Martius, who employed it in regard to complicated reactions to designate the case where the thought, instead of acting exclusively upon the idea of the sensorial signal or that of the responsive movements, concentrates itself chiefly upon the associative connection of the signal with the corresponding movement. The observations on which the author has based his classification consist of a series of individual studies, for which he states the quantitative results, attaching, however, even greater weight to the introspective reports of each subject, which form a marked feature of the work and include a minute and careful account of the bodily signs of the different kinds of attention and inner speech (*langage interieur*). This introspective study gives to the work a freshness and interest usually lacking in studies of reaction times.

THEODATE L. SMITH.

Kritische Psychiatrie. Von DR. MAX HERZ. Wien, 1895, pp. 124.

Dr. Herz gives us here some "Kantian studies in the disturbances and misuse of the pure speculative reason." He would make the doctrine of the pure reason useful for psychiatry. Since Kant, as Schopenhauer remarks, recognized the human mind as a machine, took it to pieces and showed, to speak popularly, how the wheels go round, there have been countless volumes written in the same spirit upon the same subject, but this "*ineinander greifendes Räderwerk*" has always been considered as working normally. Dr. Herz tries to show how the machine works *abnormally*, disease being, as Krafft-Ebing remarks, only function under abnormal conditions. Hence the name, the Critical Psychiatry. Accordingly Meynert is termed the Locke of psycho-pathology, because of his Kantian philosophical tendencies. The work deals largely with an exposition of the *Kritik d. r. Vernunft* and with the application of psychiatrical cases to fit and illustrate it. He treats of the disturbances of general logic, of the "*Erkenntnisvermögen*," of apperception, of concepts, and of the ideas (pathological cosmology and pathological theology).

The author shows much acuteness and learning, but, nevertheless, the work appears to bear no fruit. Psychology has grown since Kant died, and Dr. Herz's *psychology* is too full of Kant's *Erkenntnistheorie*, "faculties," separate mental water-tight compartments, "*ruhende Iches*" and other wreckage to make it an advance in present psychology or psychiatry.

ARTHUR ALLIN.

Die Philosophie des Selbstbewusstseins und der Glaube an Gott, Freiheit, Unsterblichkeit. Systematische Grundlegung der Religionsphilosophie. Von DR. GÜNTHER THIELE, Berlin, 1895, pp. 510.

This large volume on the philosophy of religion from a German professorial chair in Königsberg does not propose to treat religion from the standpoint of anthropology, psychology or the historical development of culture, but proposes to justify epistemologically and philosophically, the religious belief in God, freedom and immortality. The need of such is all the greater, since, according to the author, it has come to such a pass that the ordinary lay-

man rejects a theological proposition for no other reason than that it stands in the Bible or rests upon Bible authority. Hence this new attempt to justify the ways of God to men.

According to the author, the one great truth and highest concept in the philosophy of religion is personality. "Only man as person is free and responsible, only personal immortality has ethical worth, only a personal God offers full satisfaction to religious and moral needs. The real kernel of the concept of personality is self-consciousness. Hence the justification of the name of this philosophy of religion, the Philosophy of Self-consciousness." Knowledge, or *Wissen*, is used here in a narrower and in a wider sense. "In the narrower sense it denotes the quiet, certain possession of a truth; in the wider sense, that peculiar psychical light which not only in thought, but also in will and desire, sensation and feeling permeates with light more or less clearly our psychical life and specifically distinguishes it from mere dead being." This element of "psychical light" common to thought, will and feeling, thus makes possible "*die dem Seelenleben charakteristische Innerlichkeit, sein In-sich-, Bei-sich-, Für-sich-sein.*" Now the knowledge of knowledge *(Wissen des Wissens)* is easy after this, and one is not surprised to find Plotinus placed as acme of the ancients and cream of the Greek philosophy in this respect. The author, then, in this spirit, guides one through the Kantian categories and endeavors to show how Kant in his cosmological and other proofs gets hopelessly entangled and involved in self-contradictions. The *regressus in infinitum* of the causal chain of world actions ought not to impose on us; "we believe rather that we must set up a dam against it, and that dam is the concept of the unconditioned, the *causa sui*, the Absolute Substance." (The "must" is instructive.) The "soul-substance" of man is said to be supertemporal, simple, continuous, etc.; the ego is the identity of knowing and willing and substantial being. At the same time it said "Hume is right; through mere self-observation we find neither an *ego*, nor an *activity* of the ego, only a coming and going and association of presentations and at most of feeling and impulsive tendencies." How this is reconcilable with the author's Philosophy of *Self-consciousness* is difficult to understand. A German professor was once asked by a student to explain an obscure portion of his own book. The professor looked perplexed and replied, "There was a time when two persons understood this passage, *der liebe Gott* and myself; *jetzt weiss es nur der liebe Gott!*" In my opinion, we have here a similar case. The author then proceeds to make "*das Setzen, Hin-meinen des Ansichseins*" or self-consciousness a category, and with the aid of Kant, Fichte, Herbart and his own "psychical light" makes out his case more or less. "The supertemporal ego as spaceless-intensive can only stand to the brain in a spaceless-dynamic relation." The usual theological doctrines *re* freedom and immortality are developed in the latter part of the volume.

The good "professor of Königsberg" has, as in duty bound, written his book; whether it will appeal in any shape or form to the modern psychologist may be questioned. Here is what the professor says of reflex action: "The last ground or reason for the transformation of a sensory into a motor impulse is the circumstance that in the state of feeling following the sensory impulse there is already contained an acceptance or rejection of this condition, that is, an impulse (*Trieb*) which produces a motor process, a reaction of the soul upon the organism!"

ARTHUR ALLIN.

NOTES AND NEWS.

PROFESSOR DELBŒUF.

It is our painful duty to chronicle the loss to science and to this Journal of our distinguished colaborator, Professor J. Delbœuf, of the University of Liège, who died suddenly at Bonn on the fourteenth of August. A sketch of his psychological activities will follow in the next number.

THE MUNICH CONGRESS.

There can be no doubt that the Munich Congress, the third International Congress of Psychology, was, as from the outset it promised to be, more important than either of its predecessors. The attendance was not quite so representative in actual fact as might have been anticipated from the printed programme, — Wundt, James, Sully, Binet, Stanley Hall, Delbœuf and G. E. Müller were among the absentees; and the weather was as unfavorable as it well could have been. But a gathering of 450 psychologists could not but include a large number of famous names, and the generous hospitality extended to members of the Congress by city, university and state was not to be entirely balked by rain, however persistent.

The Congress sat from Tuesday, Aug. 4, to Friday, Aug. 7, inclusive. Proceedings may be said to have opened, however, on Monday evening, when an informal reception was held in the Café Luitpold. The two presidents, Professors Stumpf and Lipps, were present, and the reception afforded a pleasant opportunity to some 150 members for the renewal of old friendships and the making of new acquaintances.

The first regular session took place on Tuesday morning, in the great hall of the university. Professor Stumpf delivered the inaugural address, using the occasion to discuss, in a somewhat controversial tone, the respective merits of Interaction and Parallelism. His paper was followed by three brief addresses of welcome, given on behalf of the state by the minister of education, Herr Ritter von Landmann, — who hoped that the psychologists would not make things too easy for the criminal, — on behalf of the city by Herr Bürgermeister Brunner, and on behalf of the university by the rector magnificus, Professor von Baur, who in the course of his remarks paid a special compliment to American psychology. The morning closed with the reading of papers, *Sur la douleur*,

by Professor Richet, and *Die kriminelle Zurechnungsfähigkeit*, by Professor von Liszt.

In the afternoon the sectional sessions of the Congress began. It is impossible to give any adequate account of the sittings of all five sections on this and the following days. Many members failed to appear at their appointed time, so that the printed order of the addresses did not by any means correspond to the order of delivery, and it was out of the question to travel from section to section with the view of listening to the discussion of especially interesting topics in all departments. I shall be obliged to confine myself to notes of the proceedings of Section I (brain anatomy and physiology, physiology and psychology of the senses, psychophysics), and can do no more than mention the fact that much important work was accomplished in Section II on the psychology of the normal individual, in III on psychopathology and criminal psychology, in IV on the psychology of sleep, dreaming, hypnosis and allied phenomena, and in V on comparative and pedagogical psychology.

At the first session of Section I papers were read by Professor Exner on "Autokinetic Movements," by Professor Morselli on "The Vascular Reflexes of Simple Perceptions," by Professor Tokarsky on "The Minimal Duration of the Simple Reaction," by Professor Ebbinghaus on "The Method of Right and Wrong Cases," and by Professor Külpe on "The Intensifying Effects of Attention." The last gave rise to a vigorous discussion, in which Professors Ebbinghaus, Exner, Lipps and Münsterberg took part. The evening was devoted to a municipal reception in the old Rathhaus, at which Herr Bürgermeister Brunner again welcomed the guests, and Professors Richet, Sergi, Baldwin, Heymans, Sidgwick, Flournoy, Geijer, Tokarsky and Saliger returned thanks to the city of Munich in the name of their respective nations.

The second general session was opened on Wednesday morning by Professor Flechsig, who lectured on "The Association Centres of the Human Brain, with Anatomical Demonstrations." This was, without doubt, the most 'sensational' event of the Congress. The address was followed by a long and fruitful discussion between the lecturer and Professors Dechterew, Ebbinghaus, Forel, Lipps and Stumpf. The session ended with papers by Professor Sergi on "The Seat of the Emotions," and Professor Preyer on "Child Psychology."

At midday the Congress adjourned for Frühschoppen to the Spatenbrauerei, where, by the kindness of Herr Sedlmayr, all who desired were conducted over the brewery. It seems, as Herr Sedlmayr remarked, a far cry from psychology to beer; but Professor Ebbinghaus found a link in the notion of a 'Spatenpsychologie.' At any rate, the visit was most enjoyable.

The proceedings of Section I in the afternoon were opened by Professor Martius, who spoke of "The Influence of Light Intensity upon the Brightness of Color Sensation." Papers were also read by Professor Bezold on "A Continuous Tone Series for Testing Defects of Hearing, and its Significance for the Helmholtz Theory of Audition" (with demonstration), by Dr. Stern on "The Perception of Gradual Change," and by Dr. Aars on *Farbensynkrasie* (induction mixture and its relation to induction contrast). Dr. Stern's thesis was discussed by Professors Ebbinghaus, Exner, Külpe and Stratton; and all the other papers gave rise to brief discussions.

In the evening, a large majority of the members betook themselves to the little Residenz theatre, where a special performance of Don Juan was given, while a select few supped with the

prince regent at Nymphenburg. The garden party which was to have been held after the theatre at Dr. Hirth's residence, was rendered impossible by a steady downpour of rain.

On Thursday morning, Professor Sommer, at a brief general session, demonstrated his new graphic method of thought reading. The rest of the day was entirely devoted to sectional work. In Section I Dr. Wadsworth spoke of "Color Perception," with special reference to defective color vision; Professor Stratton described experiments on vision made without inversion of the retinal image; Dr. Wolff read a paper on "A Relation Between Irradiation and Simultaneous Contrast;" Dr. Kaes gave the results of an examination of the cortices of a two-years-old microcephalic girl and of a twenty-five-years-old macrocephalic female dwarf; Dr. Vram discussed "The Centrifugal Course of the Sensory Excitation produced by Visual Images," and Dr. Marbe stated his theory of intermittent visual stimulation. In the afternoon, Dr. Marbe demonstrated a series of photographic grays, and papers were read by Dr. von Schmidt on "The Definition and Seat of the Mind," by M. Courtier on "Capillary Circulation in its Relation to Psychological Phenomena," by Dr. Wreschner on "The Theory of the Time Error," by Dr. Hering on "The Integrity of Centripetal Nerves as a Condition of Voluntary Movement," and by Professor Wedensky on "The Study of Central Innervation." The addresses of Professor Stratton, Dr. Wreschner and Dr. Hering were followed by brief discussions. At the close of the session Dr. Stern demonstrated an apparatus for the production of continuous tonal change. It may be mentioned here that various firms, notably Herr Zimmermann of Leipsic, had sent pieces of apparatus to Munich for exhibition. They were laid out in one of the rooms of the physical laboratory, and were demonstrated at different times by Dr. Schumann. A demonstration of movements of the soft parts of the thorax by means of the Röntgen rays attracted considerable attention.—The English-speaking members of the Congress lunched together at the Café Luitpold. In the evening the formal Congress dinner was held at the same place.

At a meeting of the International Committee, held early on Friday morning, it was decided that the fourth Congress meet at Paris in 1900, with Professors Ribot and Richet as presidents, and M. Pierre Janet as secretary. On the same morning, at the last general session, lectures were delivered by Professor Brentano on "The Doctrine of Sensation," by Dr. Pierre Janet on "Somnambulistic Influence," by Professor Ebbinghaus on "A New Method for Testing the Mental Capacity of School Children," and by Professor Lipps on "The Concept of the Unconscious in Psychology." The third lecturer aroused special enthusiasm. At the conclusion of Professor Lipps' address, Professor Stumpf made a few remarks, retrospective and prospective,—and the Congress was at an end.

At lunch time there was a reunion of old Leipsic students in the Café Luitpold. The projected excursion to the Starnberger sea in the afternoon was replaced, in consequence of the weather, by an informal gathering in the great hall of the Kunstgewerbehaus.

It will be evident, from the above summary sketch, that the festal side of the Congress impressed the visitor as strongly, or nearly as strongly, as its scientific side. That the psychologists appreciated the efforts made for their entertainment no one could doubt who heard the speeches delivered on Tuesday and Thursday evenings. And it is, of course, almost a truism that the great benefit to be derived from any such convention lies rather in the results of personal intercourse than in those of attendance at a

series of lectures. We must wait to read the latter in the official *Bericht*,—which is promised for the end of November.

No account of the Congress should conclude without a word of cordial thanks to the general secretary, Dr. Frhr. von Schrenck-Notzing, upon whom all the labor of detailed arrangement devolved. M. Janet will find it a hard task to succeed so self-sacrificing and capable an organiser. E. B. T.

Books Received.

Adams. The Law of Civilization and Decay. An essay on history. The Macmillan Co., New York, 1896. Pp. 393. Price, $2.

Aubry. La Contagion du Meurtre. Étude d'anthropologie criminelle, 3d edition. Bibliothèque de philosophie contemporaine. Félix Alcan, Paris, 1896. Pp. 308. Price, 5 f.

Fouillée. Le Mouvement Positiviste et la Conception Sociologique du Monde. Bibliothèque de philosophie contemporaine. Félix Alcan, Paris, 1896. Pp. 379. Price, 7.50 f.

Gory. L'Immanence de la Raison dans la Connaissance Sensible. Bibliothèque de philosophie contemporaine. Félix Alcan, Paris, 1896. Pp. 346. Price, 5 f.

Haddon. Evolution in Art; as Illustrated by the Life-Histories of Designs. With 8 plates and 130 figures in the text. Pp. xviii-364. Price, $1.25. The Contemporary Science Series, imported by Charles Scribner's Sons, New York.

Kraepelin. Psychologische Studien, Erster Band, 2 u. 3 Heft. W. Engelmann, Leipzig, 1896. Price, 7 m.

Lombroso et Ferrero. La Femme Criminelle et la Prostituée. Traduction de l'Italien par Mme Louise Meille. Bibliothèque de philosophie contemporaine. Félix Alcan, Paris, 1896. Pp. 679. 13 plates. Price, 15 f.

Mach. Popular Scientific Lectures. The Religion of Science Library No. 21. The Open Court Publishing Co., Chicago, 1896. Pp. 313. Price, 35 cts.

Obersteiner. Bau der nervösen Centralorgane. F. Deuticke, Leipzig u. Wien, 1896. Pp. 572. Price, 14 m.

Ratzel. The History of Mankind. Translated from the second German edition by A. J. Butler, M. A., with an introduction by E. B. Tylor, D. C. L. Vol. I. The Macmillan Company, New York, 1896. Pp. xxiv-486. Price, $4.

Studies from the Yale Psychological Laboratory, Vol. III, 1895. New Haven, 1895. Pp. 110. Price, $1.00.

Swâmi Vivekânanda. Yoga Philosophy. Lectures delivered in New York, 1895-96, on Râja Yoga, or Conquering the Internal Nature. Also Patanjali's Yoga, with commentaries. Longmans, Green & Co., New York, 1896. Pp. 234.

Titchener. An Outline of Psychology. The Macmillan Company, New York, 1896. Pp. xiv-352. Price, $1.50.